FINAL REPORT

December 1989

Efficient Irrigation Management and System Turnover TA 937–INO–Indonesia

Volume 1
Summary and Recommendations

Presented to

Directorate of Irrigation I
Department of Public Works

Asian Development Bank

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International Irrigation Management Institute
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Acknowledgements

The Study Team, composed of members of the Directorate General of Water Resources Development (DGWRD) and the International Irrigation Management Institute (IIMI), would like to thank all those who have participated in the Phase II study of Efficient Irrigation Management and System Turnover. It is impossible to mention the names of all who have contributed but an attempt has been made to acknowledge the major contributors.

Within DGWRD, first and foremost the Study Team wishes to thank Ir. Soebandi Wirosoemarto, Director-General for his continued strong support. Similar thanks are also extended to Ir. Kusdaryono, Staff Ahli Menteri Pengairan. Within the Directorate of Irrigation I, particular thanks are due to Ir. Soenarno, M.Sc, Director, and his predecessor, Ir. Soewasono, to Ir. Rubini Yusuf, M.Sc, to Ir. Winarno Tjiptorahardjo, Head of the Sub-Directorate for Operation and Maintenance, and to Ir. Soekarso Djunaedi, Head of Tertiary Development, Ir. Soeseno, and Ir. Sutiyadi.

Within Directorat Bina Program Pengairan our thanks are due to Drs. R. Hamudji Waluyo, BIE and Ir. Djoko Sardjono.

In the Provincial Irrigation Services, the Study Team would like to thank the following for their time and inputs into project activities. In Bandung, Ir. Maman Gantina, Head, Pengairan, Ir. Affandi Apun and Ibu Suliyanti; in Cirebon, Ir. Hadzan Sumalidjaja, Ir. Sardjono and Ir. Kadar; in Sumedang, Ir. Soeharyono; in Kuningan, Ir. Suryadi; in Lampung, Ir. Yoesmen and Ir. Suhardjo; and in Solok, Ir. Basuki and Ir. Asminan. All of these people have fostered project activities, made their field staff available and provided access to data and other information. Their assistance has been invaluable.

Thanks are also extended to Dr. Alirachman and Dr. Effendi Pasandaran at BAPPENAS; Dr. Ahmad Fagi and his staff at Sukamandi Research Institute for Food Crops; to Dr. Sudjadi at the Soil Research Institute in Bogor; to Dr. Soeprodjo Pusposutardjo, Dr. Abdul Rozaq, and other members of the Faculty of Agricultural Engineering at the University of Gadjah Mada.

Within the Asian Development Bank the Study Team would like to thank Dr. Satish C. Jha, Dr. Frank J. Poleman, Mr. M.E. Tusneem, and Mr. Jan van Heeswijk in Manila, and Dr. Richard M. Bradley in Jakarta, for their inputs into project formulation and implementation.

At the Ford Foundation thanks are due to Dr. David Winder and his predecessor, Dr. Tom Kessinger, and Dr. John Ambler and his predecessor Dr. Frances Korten.

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Volume 3: Small Scale Irrigation Turnover Program

1. THE STUDY CONTEXT

This study on Efficient Irrigation Management and System Transfer has been carried out under a Technical Assistance Agreement (TA 937-INO) financed by the Asian Development Bank (ADB) and the Ford Foundation. Additional support has been provided by the Government of Indonesia and the International Irrigation Management Institute (IIMI).

Under the Terms of Reference for the Project, IIMI agreed to undertake a series of activities in conjunction with the Directorate General of Water Resources Development (DGWRD) of the Ministry of Public Works that address issues of irrigation management and develop a set of tested recommendations for adoption within the Indonesia irrigated agriculture sector. Two full-time international staff have been posted in Indonesia, together with a full complement of national staff hired directly for the project and counterpart staff seconded from DGWRD and Provincial Irrigation Departments.

The study commenced on 1 October 1987 and is scheduled for completion on or before 31 December 1989.

In providing financing for this study, both ADB and the Ford Foundation recognized that there is need to continue to improve irrigation management to maintain the advances achieved by irrigated agriculture in Indonesia over the past two decades.

The past two decades have been characterized by major loans for the expansion of irrigation into areas outside Java, and for rehabilitation and upgrading of systems within Java.

During this period Indonesia made a transformation from the world's largest importer of rice to self-sufficiency. However, much of this increase can be attributed to increases in total irrigated area following large investments in new systems and rehabilitation of older, deteriorated systems, combined with the widespread adoption of high yielding modern rice varieties.

As total rice production neared and then reached levels of self-sufficiency, government investment priorities moved away from continued large capital investments in rice-based irrigation towards a more sustained, self-financing irrigation sector that has a more diversified cropping base.

This coincided with a dramatic fall in oil prices that had been the main source of foreign revenue for the Government of Indonesia that forced cut-backs in many areas of government spending and limited the opportunities for additional foreign loans. The Government, with the support of the major donor agencies, has adopted policies of reducing subsidies and increasing the export potential of non-oil products. These policies have directly affected programs for the irrigation sector.

The government has, in recent years, started to move away from subsidized irrigation by reducing national support for O&M expenses of Provincial Governments, expecting them to finance their own irrigation programs. In making such a transition, however, it is clear that not only is there a need for greater emphasis on revenue generating measures such as the introduction of irrigation service fees but also on cost reduction measures and more efficient use of existing irrigation infrastructure.

This study has focussed on developing cost effective procedures that can stabilize financial requirements by making more efficient use of existing resources. It complements but does not replace parallel activities that aim to increase revenues through irrigation service fee collections.

In formulating policy changes for the irrigation sector, the Government recognized that there were a number of problem areas that needed to be targeted. These problem areas include inadequate integration of irrigation with other agricultural development activities, implementation problems related to the capability of Provincial Irrigation Services to manage increasingly complex irrigation infrastructure, and low levels of utilization and maintenance of existing resources.

The Government therefore formulated a series of policies that aim at alleviating these problem areas. Specific measures include:

- providing O&M budgetary support in line with actual needs of different irrigation systems rather than providing support on an area basis;

- shifting O&M funding support away from National to Provincial sources, and by introducing irrigation service fees;

- restructuring and strengthening Provincial Irrigation Services to provide them with greater capability to manage systems under their control; and

- transferring O&M responsibilities from Provinces to Water User Associations in small irrigation systems, initially involving systems less than 150 ha in Repelita V but extending to systems up to 500 ha in the following decade.

Many of the activities are currently included in the two major loans to the irrigation sector, the World Bank Irrigation Sub-Sector Loan and the ADB Third Irrigation Sector Loan. In both of these loans, however, there is limited scope for studies that address in detail some of the implementation issues that may arise. To assist the Government in achieving progress in implementation of effective irrigation management, ADB has therefore provided two Technical Assistance Grants to IIMI and the Government of Indonesia to examine current management practices and develop alternative procedures for testing and adoption by Provincial Irrigation Services to make them more efficient in the utilization of existing resources.

Phase I: Study of Irrigation Management in Indonesia

The first Technical Assistance grant was made in 1985 to the Government of Indonesia through DGWRD, using IIMI as the primary contractor, to undertake a series of studies that addressed two major areas:

- Crop Diversification, examining the technical and socio-economic factors constraining the adoption of more intensive palawija (non-rice) crops during the dry season when there is insufficient water to grow rice; and

- Irrigation System Management, assessing system performance levels in various systems, and examining management systems, capacities, constraints and relationships which influence system performance.

In both areas DGWRD and IIMI jointly developed and pilot tested a set of procedures designed to overcome identified constraints to improving the overall utilization levels of existing irrigation infrastructure. These recommendations were based on field activities in East, Central and West Java and were fully reported in the Final Report for Phase I.

Because there remained a need to address irrigation management not just at system level but as a set of planning and coordination activities at higher levels, it was recommended that a second grant be made to continue the development of additional procedures, and work with Provincial authorities towards wider adoption and dissemination of successfully tested procedures.

Based on these recommendations and with continued interest by the Government of Indonesia in continuing the program further, a proposal was developed for a second Phase of the project that expanded the scope, and included work on turnover of operations and maintenance to farmers in small systems. This proposal, submitted to ADB and the Ford Foundation, was accepted and the study was able to move directly into a second phase without a break in the continuity or momentum of activities.

Phase II: Efficient Irrigation Management and System Transfer

The Phase II project continued much of the work initiated under Phase I with respect to irrigation system management, and was expanded to provide inputs into the program of hand over of O&M responsibilities to farmers in small irrigation systems. The two basic components of Phase II have been:

- Efficient Irrigation Management: an assessment of ways in which current system management activities can be implemented more effectively, and pilot testing of alternative procedures which could be adopted; and

- System Turnover, where the Study has a role in the monitoring and evaluation of the pilot program to turnover O&M responsibilities in systems less than 150 ha to water user organizations in the Provinces of West Java and West Sumatra, and to develop recommendations for changes in the program as it is expanded to cover larger systems (up to 500 ha) and spread into other Provinces.

The geographical scope of activities was widened to include two provinces in Sumatra: Lampung for Efficient Irrigation Management, and West Sumatra for System Turnover. To accommodate the spread of activities, field activities in East and Central Java were discontinued.

Format of The Final Report

The Final Report is in three volumes.

Volume 1 provides an overall summary of the major conclusions and recommendations that have resulted from the entire study.

Volume 2 is concerned with Efficient Irrigation Management and is divided into individual sections that address specific aspects of irrigation management. The results and conclusions are presented in a sequential order as follows:

1. Introduction to issues of irrigation system management, and brief descriptions of the study sites;

2. Information Base for Irrigation Management, examining ways to upgrade the data base required for effective use of existing irrigation facilities;

3. Procedures for Upgrading Basic Information, which provides a detailed description of tested procedures ready for adoption and dissemination;

4. Irrigation System Operations, which examines ways in which irrigation facilities can be more effectively used under normal water conditions;

5. Rotational Irrigation, which examines ways in which existing irrigation facilities can be more effectively used under conditions of water scarcity, and includes a full description of pilot tested procedures ready for adoption and dissemination;

6. Management Between Irrigation Systems, which looks at what is required in respect of annual planning, reservoir management and management of water between irrigation systems served by a common river; and

7. Alternative Operational Procedures, which require a re-orientation of existing operational objectives and operational plans to accommodate alternative approaches to management of existing facilities, and effective use of limited funds for rehabilitation and special maintenance.

8. National and Provincial Support for Improved Irrigation Management, examining some of the overall policies and support measures that are required at high levels to promote effective irrigation management in Indonesia.

Volume 3 reports on System Turnover after the first two years of the pilot program to give farmers full operation and maintenance responsibilities in systems under 500 hectares. This volume is also divided into a sequential set of sections that address the following issues:

1. Turnover Program Policy and Process, defining the current objectives and methods of implementation of turnover activities in Indonesia;

2. Policy, Administrative and Management Implications of the turnover program as it is currently envisaged;

3. Management Perspective of current turnover activities and their effectiveness for long term responsibilities of farmers and government;

4. Field Information Collection, with a focus on collection of the minimum data base required for effective planning and implementation of turnover;

5. Design Stage, with an evaluation of existing inputs into design of physical works required prior to turnover;

6. Construction Stage, examining the current experiences with construction, and seeking ways to make this stage more efficient and effective;

7. P3A Development, and requirements for successful implementation of turnover of O&M responsibilities to P3A;

8. Capability of Provincial Departments in the entire process of site selection, design, construction, P3A development, and final hand over of responsibilities; and

9. Conclusions that address some of the issues that need to be resolved if the pilot program is to be successfully disseminated into other provinces.

The intention is that each volume is self-contained and can be used independently of other volumes if desired. However, it should be recognized that Provincial Departments have to be concerned with the interactions between all aspects of irrigation management in both large and small systems in order to make the most effective us of staff and financial resources.

EFFICIENT IRRIGATION MANAGEMENT

MAIN FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This section reports on the main findings, conclusions and recommendations that have resulted from the Phase II study. Throughout these activities specific efforts have been made to develop inexpensive ways of improving system management on the basis that probable available budgets to Provincial authorities will not exceed the proposed level of Rp.25,000 per hectare per year in the near future. It is expected that any additional costs involved in implementing recommendations laid forth in this report should be covered by annual budgets of this magnitude, but that it is unlikely that the majority could be implemented while average budgets remain at their present level of around Rp.12,000 per hectare.

Current budget levels have been decreasing in actual terms for the past few years. If this trend were reversed and management-oriented procedures such as those presented in this report were implemented, it is expected that the net benefits would greatly outweigh the relatively modest costs involved.

1. Information Base for Irrigation System Management

Effective irrigation management can only be achieved when there is sufficient information available concerning basic agricultural and hydrologic conditions prevailing in each system, and where there is an appropriate set of procedures for incorporating this information into daily and seasonal management tasks.

Information management is an evolutionary process that starts by utilizing generalized information and assumptions generated for design purposes, and then gradually replaces these assumptions with site-specific information collected as part of the regular monitoring of system operations.

Results from all IIMI study sites indicate that, even after many years of operation, there is a continuing use of assumed values for data and that procedures for updating basic system information remain relatively weak. The effect of the gap between actual and assumed values means that it becomes difficult to effectively manage available water supplies to maximize its productive potential, and most systems studied are considerably less efficient than they could be.

A focus of IIMI activities during the past four years has been to develop simple but cost-effective methods for simultaneously upgrading basic information about individual irrigation systems, and developing procedures for incorporating this information into operational activities.

Estimating Water Availability

Effective irrigation management in the dry season depends on knowing how much water is likely to be available at the intake into the system. There are two main uses of such information:

- seasonal planning of the overall area to be irrigated and the most appropriate mix of crops to be recommended when there is insufficient water to grow rice throughout the command area, and

- operational planning that calculates both supply and demand at periodic intervals throughout the dry season to ensure that short-term operational plans are consistent with actual water conditions.

From the perspective of planning activities, the area to be irrigated in each season is intended to be based on the minimum discharge available four years out of every five (80% probability). However, if this information is not available, system managers tend merely to recommend the same area for irrigation each year irrespective of how efficiently the system was managed.

IIMI studies show little evidence of systematic analysis of water availability at the head of irrigation systems. Although data are collected on a daily basis on flows into systems, there is less attention paid to calculating predictable river flows.

The same is true for determination of shorter term changes in water availability. Water supplies at the head of the system for the next irrigation period are generally assumed to be the same as in the preceding period. This does not account for the normal pattern of declining discharges throughout the dry season, or make allowances for periods of abnormally high flow caused by isolated rainfall in the dry season.

In general, there is no evidence of planning ahead over several irrigation periods: system managers draw up contingency plans for periods when water supplies are likely to be lower than demand, but they respond to already existing water shortages rather than make efforts to predict their occurrence and implement changes in operations as soon as they are required.

Assessing Irrigation Demand

In contrast, considerable emphasis is on the assessment of irrigation demand for each irrigation period. It is standard practice to recalculate demand for each tertiary block in irrigation systems every 10 or 15 days, depending on local practices. Results indicate that there are in many cases substantial errors in the basic data available for assessing irrigation demand that limit the levels of efficiency that can be achieved.

The process of demand calculation requires knowledge of several factors: the actual irrigated area in each tertiary block, the type and area of each crop in every block, and the water requirement for each crop being grown. For each of these three factors it is clear that there is considerable reliance on estimates rather than precise information.

The irrigated area of tertiary blocks, particularly in older systems, tends to become smaller over time as land is converted from agricultural to non-agricultural uses such as housing, roads, or industrial development. However, these changes are not reflected in the official records of the irrigated area on an annual basis, with updating only occurring once every few years. If budgeting for O&M is calculated on actual needs, rather than on the official irrigated area, there should be no administrative problems associated with keeping track of changes in the areas of tertiary blocks over time.

Because irrigation inspectors tend to use the official rather than actual areas, they normally inflate the actual cropped area for each tertiary block. This overestimates the total irrigation demand for that block, and reduces the potential for additional irrigation in blocks at the tail of the system. A second major problem in estimating demand is that each tertiary block is assumed to receive water only from its authorized gate. Official records rarely allow for the fact that in many systems significant changes in the tertiary conveyance system have already occurred. These changes result from suppletions (additional water sources) that were not included in the original design, but which are legitimate uses of other water sources. Suppletions that transfer water from one tertiary block to another often compensate for inaccurate assumptions in the design phase about which area should be irrigated from each tertiary structure. Similarly, there is no account taken of reuse of drainage water or village weirs in smaller rivers crossing the irrigation system that supplement water supplies at the head of the system.

The same process of overestimation of demand occurs when reports are made of the area under each crop type. Irrigation inspectors are well aware that their water allocation within each irrigation period is based on their estimated demand rather than on a fixed share of available water at system level. There are therefore potential benefits to be made from overestimating the area cultivated in crops with high water requirements, notably rice, and underestimating the area under fallow. In some systems studied it is common to find that land which is actually fallow is reported to be under palawija crops. This provides a more favorable figure for dry season cropping intensity and inflates the demand for water into each tertiary block.

In all study systems a set of standard water requirements are utilized. Rice and sugar have detailed water requirement data, but for palawija crops the most common procedure is to define each crop as having either high or low water use. There appears to be no general agreement as to which palawija crops fall into which category, nor is there any sensitivity to growth stage or actual water requirements. There is little change in the estimated water requirement for each tertiary block within any given season: once the seasonal requirement has been calculated once, it does not significantly change until harvesting commences.

There is little sensitivity to changes in soils or groundwater conditions. It is normal for crop water requirement estimates to be uniform throughout any given irrigation system even though soils and drainage conditions differ significantly from one part of a system to another.

The procedure of allocating available water based on demand estimates may encourage irrigation inspectors to overestimate their requirements so that they get a larger share of available water. This has a particularly negative effect when water supply cannot meet all demand, and water has to be rationed or rotations adopted. There is no effective procedure or incentive to evaluate and correct this trend.

It is difficult to justify the administrative load involved in the two-weekly recalculation of demand in each system when the data base is not particularly accurate, and where system conditions mean that discharges cannot be measured with the desired precision. Until such time as system level information is more precise, it would be more efficient to adopt a simpler set of procedures for calculating water demand at each major structure in irrigation systems.

Estimation of Conveyance Losses

A second major loss of efficiency comes in the use of generalized estimates of conveyance losses. In the design phase it is necessary to have some figure for conveyance losses so that canals can be correctly sized to carry the peak irrigation demand. Normally this is for land preparation for rice.

In the operational phase, however, conveyance losses take on a different significance. Conveyance loss estimates are the difference between total demand for all tertiary blocks and water requirements at the system head. Design guidelines assume losses of 15-22.5% for tertiary canals, and 7.5-12.5% for secondary and main canals, or a total system delivery efficiency between 60-75%. If actual losses differ significantly, then the process by which demand at the system head is calculated becomes invalid. In the dry season, when water supplies are less than demand, and where actual discharges are significantly lower than design discharges, conveyance losses may be critical in determining whether operational plans are feasible.

In none of the study systems prior to this study had there been any field measurements of conveyance losses: only the design phase assumptions were being utilized despite many years of operation of the systems. Field results show losses are more variable and normally much higher than assumed values. The data also underline the importance of being sensitive to the length of canals, the condition of the canal, whether it is lined or unlined, soil and topographic conditions, and relative location in the system.

Discharge Measurement and Control Capability

Indonesian irrigation systems, based on periodic and frequent recalculation of demand and supply, require the presence of functioning measurement structures, and the capability to control water levels and discharges with a high degree of precision. Without such measurement and control capability system operation becomes more a matter of personal judgement or guesswork than systematic and precise irrigation management.

In none of the study sites is the measurement and control capability sufficient to operate the systems as intended. Control capability is always better than measurement capability, and normally sufficient to allow control over flows into main and secondary canals. This means that there is normally sufficient capability to control water levels, and to implement rotations when required. At tertiary level there is reduced ability to maintain control over flows because a higher proportion of gates are broken or damaged: typically less than 80% of tertiary gates function properly.

Measurement capability is significantly lower, even at main and secondary level. In a high number of cases, even where measuring structures exist, they have not been recalibrated and have significant measurement errors. Tertiary level measurement capability is generally very poor. Discharges cannot always be measured at secondary heads, and 40-60% of tertiary measurement devices are broken or missing. This undermines the whole concept of demand-based calculations of precise target discharges to each tertiary.

Upgrading Basic System Information

These findings indicate that if irrigation management is to become more efficient then more effort has to be placed on improving the knowledge and strengthening the information base available to system managers. The overall need is to gradually replace assumed values and conditions with information on actual field conditions so that water supplies and demand can be better balanced, and overall efficiency of irrigation can be improved.

During this Phase II project emphasis has been placed on the development and implementation of low-cost methodologies that permit system managers to upgrade their information base using existing staff resources. The objective of these information-strengthening activities has been three-fold:

- to develop low-cost methods for strengthening the information base required to improve levels of irrigation management in the field;

- to enhance the skills of field-based staff in data collection procedures through on-site training activities in their irrigation systems, under normal operating conditions; and

- to foster the use of the upgraded information in the standard procedures used for determination of irrigation supply and demand, and subsequent development of operational plans for each irrigation interval.

A training program was developed to supplement improved operational procedures incorporated as part of the Advanced Operation Units of the West Java Irrigation Project where there have been significant changes in procedures for reporting field conditions. However, it has proved possible to successfully adopt the same techniques in other systems.

The results of this program, which has been conducted in several systems in West Java and Lampung, show that it is possible with relatively limited financial resources to significantly upgrade knowledge of system conditions and to incorporate actual values rather than assumed values into operational procedures. Although it is premature to assess the impact of these activities on system performance, the response so far from the irrigation staff involved has been very positive. The activities focussed on:

- mapping of tertiary block areas by field staff using basic equipment to determine overall command area and the boundaries of individual holdings. These maps permit more accurate assessment of total irrigable area, allow irrigation inspectors to more easily assess the actual cropped area and the crops being grown at any given time, and to determine whether there are suppletions or other sources of water that can be used in determining actual tertiary block water requirements. It may be that as the Irrigation Service Fee program develops, other maps may become available that are more accurate, but until that time field mapping based on simpler techniques will meet current field needs.

- calibration of discharge measurement structures to permit greater control over water deliveries. This activity focussed on use of existing measurement structures or gates, either directly where hydraulic conditions were favorable, or through measurements of discharge using portable flumes that allow gates to be calibrated.

- determination of conveyance losses in main and secondary canals under different water conditions to determine the actual range of values to be utilized in the procedures for determination of target discharges.

- introduction of random and periodic spot-checking of the ratio of planned to actual discharges on purpose-made forms to facilitate better monitoring of water delivery performance.

- introducing procedures for interviews of WUA members by irrigation staff to determine WUA water problems and develop pragmatic solutions.

A longer term aim of the program is to follow up improved data collection with evaluation of the operational practices to determine whether current operational plans are optimal, to investigate the opportunities for making changes in operational procedures, and to strengthen the evaluation procedures to achieve long-term improvements to irrigation system effectiveness. It has not been possible in the time frame available to implement this set of follow-up activities.

2. Irrigation System Operation

Effective irrigation system operation involves an on-going set of adjustments to gates and structures that balances out fluctuations in both supply and demand. As described earlier, it is also necessary to have a sound information base and the physical facilities for water control and measurement. To support operational activities, system managers have to ensure that there is an adequate communication process that allows coordinated changes in gate operations throughout the system both under normal conditions with continuous flows, and under water short conditions that require implementation of rotations, that the physical infrastructure is adequately maintained to permit operational tasks to be carried out, and that predictable changes in water supply conditions can be planned in advance in a systematic manner.

The field studies conducted in respect of operations all show that there are significant opportunities for improvement in all of these areas that could lead to increases in operational performance without undermining the existing operational objectives. In large measure the major deficiency is one of coordination of activities between these tasks, and between different parts of the irrigation system. At present there is a tendency for actions to be relatively uncoordinated, resulting in an overall reduction of potential effectiveness of system operations.

Gate Operations

It is clear from all of the study areas that there are significant variations between planned and actual operations. These variations may be the result of many factors, and can be viewed as both positive and negative.

Major factors that influence whether a set of planned operations can be implemented are the level of resources and type of information provided to field level staff. If there are deficiencies in either of these areas it becomes difficult, if not impossible, for field level staff to undertake their tasks with great precision however conscientious they may be.

For operation of the irrigation system field level staff are normally instructed to deliver a certain target discharge into each canal within their jurisdiction. However, if there are no conversion tables available, and if measurement devices are either missing or broken, it means that gate operators have to rely on estimates of flows rather than measurements. Similarly, if irrigation conditions are not stable, such as fluctuating main and secondary canal discharges, it may be impossible for gate keepers to make frequent and systematic adjustments to all their gates to accommodate this variability and still maintain target discharges.

A further cause of deviation from planned operational targets is that both irrigation inspectors and gate keepers make legitimate adjustments to accommodate site specific conditions. Their more intimate knowledge of local conditions allows them to know whether discharges should be modified to allow for changing crop conditions, for presence of suppletions or other additional water sources, or other conditions not inlcuded in the official operational plan. As long as these adjustments are relatively minor, then this local flexibility is effective.

A continuing characteristic of discharge measurement is that data reported from the field to the office of the manager tends to reflect planned targets rather than actual data. This is not merely because actual measurement is difficult or impossible at many locations, but also because field staff can avoid conflict with their superiors by reporting that plans were achieved rather than by reporting actual conditions.

Typical gate operations lead to inequitable access to water: at individual structures small canals generally get more water than larger ones, head end channels normally get more water than tail end ones, excess deliveries occur frequently, and gate operations are frequently uncoordinated and made too late to meet field requirements.

The result is that implementation of detailed plans based on precise water control is not actually happening, and that there is a significant divergence in the field between planned and actual conditions. However, it has to be recognized that some of this difference is legitimate, representing genuine management efforts by field staff to compensate for inaccuracies in the planned targets they have been instructed to implement.

Coordination of Operations

Effective information flow is only possible when information flows both from the field to the manager and from the manager to the field. In all of the study sites the main flow of information is from irrigation managers to the field, based largely on assumptions about system level conditions. There is much less return flow of information from the field staff to managers that would permit them to make more responsive plans for improved operation.

This one way flow of information means that while irrigation inspectors and gate keepers receive periodic instructions, there is no effective way to determine whether these instructions were appropriate or whether they were actually implemented. This leads to a continuing divergence between what managers think is happening, and the reality of events in the field.

Typically upstream irrigation inspectors take more than their share of water, do not distribute water fairly throughout their area, and do not pass on the correct amount of water to downstream areas. However, in most cases there is poor control or measurement capability at boundaries between irrigation inspectors, and there is no effective monitoring or evaluation procedure for system managers to determine how well irrigation inspectors are performing.

Although there are formal procedures for reporting to system managers, and for receiving instructions on what target discharges should be, a great deal of the information flow is laterally between irrigation inspectors on a much less formal basis. The overall effect is a dual system of management of irrigation systems that further separates plans and actual conditions.

The balance in upward and downward information flows is important. If water is not particularly short, field staff can make small adjustments to water conditions. They already do this, but without proper standing orders it is impossible to determine whether the effects of informal management will be equitable or meet overall system objectives. However, there should be clear limits as to how large these adjustments can be so that major discrepancies in access to water between different parts of the system are not permitted to occur. When water is in shorter supply, however, the flexibility for field staff must be reduced so that equity objectives can be maintained.

Maintenance and Repairs to Support Operational Objectives

In all systems included in the study it appears that maintenance activities are undertaken in a rather uncoordinated manner, and do not relate specifically to operational objectives. Priorities are not geared to improving operations. There is little effort to maintain measuring devices, indicating the overall lack of concern with actual discharges, and gates are not normally repaired until they reach a stage where they can no longer function at all. It is more effective to focus these activities on control and measurement at heads of main and secondary canals, and at irrigation inspector boundaries rather than on the degree of physical deterioration.

The same is true for canal lining. Most systems in the study have some plans for on-going lining of parts of the system, but there is no evidence that the locations of this lining were chosen because conveyance losses were actually higher in those sections than in other parts of the conveyance system. It appears that the level of deterioration rather than conveyance efficiency is the major method of determining what should be lined.

Similar observations have been made on canal cleaning. Although cleaning does occur every year during the period of annual closure, there is little sign that critical portions of the canal system are cleaned. This reflects the lack of systematic feedback of information on the hydraulic performance of the system in respect both of actual discharges and conveyance losses.

Observations show that although maintenance of main and secondary canals is officially the responsibility of Public Works, farmers play a considerable role in assisting in clearing of canals. This may be relatively organized, as in the periodic cutting of weeds in the main canal at Way Jepara, periodically arranged by irrigation staff when the need arises, or spontaneous and independent action by farmers when water supplies are under threat. In all cases, better coordination would be beneficial.

3. Rotational Irrigation

The implementation of rotational irrigation provides particular difficulties for field staff. The extent to which rotations can be effectively implemented and controlled depends on stability of flows upstream in the system, and on the nature of the rotational timetable. If rotations break down in upper parts of the system, it becomes impossible to maintain a fair and organized schedule in the tail end areas of the system.

Evidence from many study systems shows there is a clear need for more equitable rotations that are easier to implement. Rotational plans favor some parts of systems either because they get water more frequently, or because there are large variations in the area scheduled for irrigation at any given time. Plans have unnecessarily complex timetables that make them hard to implement, and lead to confusion as to whose turn it actually is. It is not unusual to find totally different rotational patterns being implemented in different parts of the same system.

Further, it is by not clear that rotational plans consider some basic technical factors, including the time required to fill up canals, the discharge requirements for each rotational pattern, or the number of gates that must be opened and closed to make the rotation effective.

There is also little evidence of proper communication of the rotational plan, or when and how it is to be adopted. This results in confusion and conflict between farmers and irrigation staff, and may result in making it impossible for irrigation staff to maintain control over critical structures. Frequently rotations are not implemented until water shortages have become critical and conflicts over water are relatively serious. This emphasizes the need to try to estimate water conditions at least a month in advance, rather than waiting for crises to arise. Given improved data on river discharge conditions, particularly in the dry season where base flow is relatively easy to predict, it should be possible for contingency rotational plans to be drawn up and discussed well in advance of actual implementation. These plans need to be more sensitive to the irrigation requirements of crops rather than merely based on the overall ratio of supply to demand.

Pilot Testing of Alternative Rotational Irrigation Plans

To assist in the improvement of rotational irrigation, a pilot testing of an alternative rotational plan in Maneungteung System in West Java showed that for virtually no cost and using the existing planning mechanisms it was possible to make significant improvements over existing plans. Water allocation was more equitable, both in the scheduling of deliveries and in the area to be irrigated each day. Management inputs of field staff in respect of gate operations and monitoring requirements were reduced by about 15%, the total time on duty per week for irrigation inspectors and gate keepers was reduced, and the operational tasks made simpler. Rotational boundaries were all defined by operational gates rather than stop logs, and flags used to delimit areas scheduled for irrigation.

Farmers were fully involved throughout the pilot testing. They participated in the selection of the final rotational plan, and they were fully involved in implementation through night inspections of gates.

The net conclusion of this pilot testing activity is that with no physical or financial inputs it is possible to significantly improve the management of water when it is in scarce supply, and result in improved relationships between irrigation staff and farmers in times when conflicts are relatively common.

4. Planning Activities Between Irrigation Systems

The irrigation manager has an important role in the management of water beyond the immediate boundaries of each irrigation system. Three components of this task have been included in the current Phase II study. The first is improvement of annual planning activities that determine overall irrigated areas and cropping plans in each administrative district. It is obvious that

both of these tasks must be closely integrated with short-term operational objectives in order to make the most efficient use of water available within each system. The second aspect deals with the issue of allocation of water between irrigation systems served by a single river to ensure that all systems receive a fair share of available water. The third addresses management of reservoirs where planning, coordination and operations all coincide.
Field studies indicate that in all three aspects decisions taken are not closely linked to actual operations, particularly when water is in short supply. There is a tendency to operate each irrigation system independently of the plan without proper regard for the wider implications for downstream users of a single water source.

Annual and Seasonal Planning

There is strong evidence that the annual planning process is largely ineffective in assisting individual system managers in making the most effective and equitable use of water supplies. Further, farmers normally do not know what the plan is, and base their cropping decisions on local factors.

It is mandated that all concerned branches of government meet in the Irrigation Committee to prepare a coordinated plan for agricultural activities, resulting in a plan that specifies the total irrigated area as well as a breakdown by crop type in each administrative area. The mechanism by which this plan is translated into operational plans is complex because administrative areas differ from hydrologic areas, and irrigation inspectors and village leaders cannot determine which farmers will plant rice or palawija crops, or which blocks will be grown to what crop.

In principle, information is collected from farmers on their preferred cropping patterns for the next year, and this information is cumulated up to Kabupaten level. This information is then compared both with cropping targets and estimates of available water, and a plan developed that meets all foreseeable constraints. This plan should then be communicated down through the system to each farmer who can make his cropping decisions accordingly.

In practice the system is not effective. Farmers tend to plant what they think is most suited to their expected water conditions, based on previous experiences, and modified by their economic and social situation. They may be encouraged to do so because operational plans take greater account of what has actually been planted rather than what the overall plan requires. The most effective way to obtain more water, particularly in the dry season, appears to be to plant as much as possible irrespective of the plan. If water is in good supply at the start of the dry season, this approach leads to greater difficulties later on when water supplies are less.

The lack of relationship between annual plans and system operation plans means that there is little change from year to year in either the official plan or in what farmers actually plant. It is, essentially, a quota system that provides guidelines rather than operationally implementable plans. In years when water supplies are higher than normal this results in a general decline in efficiency because the planted area is less than it could have been, while in water short years there is an inevitable decline in productivity due to water scarcity.

Rivercourse Management

Public Works has the responsibility to help coordinate water allocations between systems served by a common water source. Although specific bodies are established for the larger rivers, particularly those cutting across provincial boundaries, the task is no less important for smaller rivers.

In the West Java study it is clear that there is almost no coordination between weir operators along a single river. Their primary concern is to ensure that the farmers in their irrigation system get as much water as they can, and not to be too concerned with conditions at weirs further downstream. Discharges into upper end systems tend to remain more or less constant while overall river discharges are dropping, while tail end systems merely divert all the flow available even if there are other systems downstream requiring irrigation water. Little information on re-use of drainage water is available that is critical in lower portions of many rivers.

This approach leads to conflicts between weir operators, and severe water shortages in lower parts of rivers while upstream systems still have access to more than sufficient water.

Part of the cause of these problems is that there is little coordinated planning of overall water requirements in all systems along a single river. Standing orders provided to weir operators generally allow them to extract a certain proportion of water available in the river (often two thirds of total supply) when there is insufficient to meet their full requirement, even though water supply for all systems along the river may be much less than that proportion. These standing orders need revision to accommodate more precision in water control, and greater equity between systems.

Lack of supervision is also problematic, particularly where weirs along a single river fall under more than one irrigation manager or Cabang Dinas. Weir operators can be confident that their activities will not be checked in the field, and that they can meet the desires of nearby farmers rather than assist in the process of water management over a wider area.

Reservoir Operations

In two of the study sites the presence of reservoirs provides opportunities for more precise control of dry season discharges than in run-of-the-river systems. Despite this potential for improved management there is little evidence that full advantage is being taken of the data available.

There is a tendency to release water from the reservoir during the dry season in response to the stored level of water rather than to the downstream demand. This appears to reflect an attitude of supplementary irrigation that is not consistent with the objective of meeting crop water requirements: reservoir releases tend to decline when field level demand is actually rising. This pattern is made worse by a general lack of responsiveness to rainfall within the irrigated area that reduces irrigation demand and allows water to be stored for use in water short periods later on in the season. In neither case studied were there analyses of the probable inflow into the reservoir in the dry season, which would help determine the optimal irrigated area, nor were there indications that the storage available each year had any influence on the annual planning process that determines the area to be recommended for irrigation. Operational rules for the reservoirs studied could be significantly improved to enhance their effectiveness as sources of irrigation water as well as to accommodate other aspects such as flood control and domestic water supplies.

5. Alternative Management Strategies

All the discussion in this section so far has been related to improving irrigation management under the existing operational objectives and using existing irrigation infrastructure. It is clear that there are major benefits that can be gained from this approach.

However, it is also important to realize that this approach has finite limits, and that there is a need for periodic review of the overall approach to irrigation management. The study therefore concludes with some observations and recommendations for more radical approaches.

Efficient irrigation management is frequently seen as an activity that deals only with day-to-day operation and maintenance of the system, and the supporting annual planning process. This view is supported by the general separation of design and construction from operation and maintenance.

However, it is clear that there are strong linkages between design and operation. The overall design has to be based on a set of assumptions as to how the system will be operated, and it is increasingly clear that in certain cases these assumptions have to be periodically re-examined.

Operational Assumptions

Current operational objectives are based on centralized allocation of water based on field reports of expected demand, with target discharges calculated to all parts of the system. Field study shows that, for a number of reasons, this process is not always followed. Although recommendations have been made for tightening up existing procedures, an alternative approach is to develop simpler and more decentralized operational procedures.

Field data shows faktor-k is generally either well above 1.0 or below 0.6, while the system is most effective when faktor-k is below 1.0 but above 0.6. This means that detailed recalculation is not necessary for most of the wet season because water is adequate to meet all demand continuous irrigation more at less at design discharge levels is sufficient. In the main part of the dry season some form of rotational irrigation is required that does not require calculation of faktor-k.

It is clear that the difference in demand between successive pasten periods is normally small, and that they are less than measurement error of most structures. Longer term target discharges would not sacrifice any performance, but would free up a lot of time so that irrigation inspectors and managers can concentrate on water delivery rather than planning unimplementable water allocations.

Further, it is not possible to implement the target discharges under present operating conditions, and it is unlikely that even with completely functional gates and measuring devices it could be managed as intended.

The alternative to the present system requires three assessments of demand: for land preparation, normal irrigation and just before harvest. If target discharges are set only for the boundary of each irrigation inspector based on these three conditions then irrigation inspectors can make the necessary local adjustments to water allocations between tertiary blocks under their control.

A further area for simplifying management is to rationalize the boundaries of irrigation inspectors so that they have proper control and measurement facilities at hand-over points, that main canal operations are under as few irrigation inspectors as possible, and that these revised boundaries coincide with rotational boundaries where feasible.

Lastly, the pasten system is biased towards head end areas because field level demand is determined by actually cropping, not by equity of access to water. If water is allocated in proportion to potential demand, not to actual demand, all areas would be treated equally, and discharges could be calculated on proportion of area, not proportion of demand.

Operations would therefore be simpler to plan, but require more effective monitoring and evaluation to facilitate development of more system specific operational plans that fit in with agricultural and hydrologic conditions

Design Considerations

It is the design phase that determines the physical facilities available to irrigation managers in subsequent operation of the system. Decisions on the type of gates to be constructed, the nature of measuring devices, and the location of structures along the canal network are all made long before operations commence.

However, there is also a set of implicit assumptions about operations included in the decisions that may make subsequent operation easier or more difficult. These implicit assumptions include such aspects as the number of gates that each gate keeper and irrigation inspector have under their control, the distances they have to travel to undertake their normal duties, the types of rotational patterns that can be adopted, and the expected cropping pattern. The most important assumption, however, is that field staff can control and manage water in accordance with the complexity of the design.

A simplification of design is likely to improve operations. The study has identified several areas where design guidelines have not been properly followed, resulting in conditions that are hard to manage. Gate sizes are poorly correlated to irrigated area, and many structures have gates with different hydraulic characteristics. This makes it hard for gate keepers to achieve target discharges under any conditions, and particularly when discharges fluctuate from day to day.

A simpler design approach that facilitates operations would be to aim to make tertiary gates proportional to the irrigable area, or as close as possible given construction constraints. This eliminates the need for detailed measurement at each tertiary because, irrespective of faktor-k values, each tertiary would receive its normal share of the total discharge available. Tertiary gates would be required to implement rotations, but these would be simple sliding gates that are suitable for completely closing the flow of water when a turn was not scheduled.

Measurement would be focused at the heads of main and secondary canals, and at the boundaries of irrigation inspectors, so that irrigation inspectors can receive their allocated share of total water available, leaving them to distribute as required among the tertiary blocks.

Rehabilitation and Special Maintenance

There is frequently a strong argument made that rehabilitation provides the best opportunity for making changes to operational objectives. However, experience shows that this is often not the case. Rehabilitation becomes overly concerned with design and construction, and in many instances these activities are divorced from the existing operational staff. Rehabilitation has sometimes become the reward for poor operation and maintenance. It should be the reward for good operations and maintenance, with O&M staff taking the lead in determining which improvements are required so that operational plans can be properly implemented.

If a system managers can demonstrate that they are already making the best use of existing resources, and that they are now constrained by physical limitations, they merit priority for physical improvements because they will likely make better use of them in the future. The issues discussed in this report highlight the fact that physical deterioration is not the only constraint to improved operations, and that mere improvement of physical structures will not necessarily result in significant improvement in performance.

When rehabilitation programs are implemented they have first to concentrate on repair to the key elements required to improve operations, so that the operational plans determine the design requirements rather than the more typical pattern of design requirements determining operational activities.

Rehabilitation plans should therefore focus on main and secondary canal control and measurement, improving conditions where water passes from one irrigation inspector to another, and on lining where conveyance loss data show it is most needed.

6. National and Provincial Support for Improved Irrigation Management

Study results show that on a pilot basis significant improvements can be made in operations with little or no cost. However, the rate of adoption and dissemination is very slow. Several reasons are behind this situation.

There is little reward for good management either for field staff or for irrigation managers. Staff are not provided incentives for more efficient water allocation or distribution, and performance is not used as a criterion for salary or promotion. Similarly, incentives at system level can be gained by getting rehabilitation funds through good performance rather than on a more arbitrary basis.

There is a natural tendency to want to develop a single model for operations even though there is great physical, agricultural and social diversity. Irrigation management is likely to be less effective if plans are imposed from the center rather than developing a process for more site-specific plans that call for decentralization of operational rules and targets. This is equally true to national, provincial and regency levels, and it will always require careful guidance from the center to assist the provinces in adopting the set of procedures most suited to their local conditions and resources.

There is little effective mechanism at present for assessing the results and experiences between different projects or different provinces. the same mistakes tend to get repeated over and over again, rather than building up a set of experiences and understanding of why some approaches are successful in some areas, while others are less successful. DGWRD is beginning to formulate the concept of a national center that will help in synthesizing the experiences of different provinces. The development of such a body will clearly help in the establishment of an national advisory service that can provide the type of comparative experience that is lacking at the present time.

Development of sustained O&M does not easily match with objectives set out in a project format. This is particularly true when projects, even in the O&M sector, are largely identified as construction-based. The presence of special maintenance (SM) in the Efficient Operation and Maintenance (EOM) and Advanced Operation Units (AOU) runs the risk of focussing on physical deficiencies and not paying sufficient attention to opportunities to improve operational activities.

The overwhelming evidence from this study is that although physical constraints limit the overall potential of operational changes, there is great potential for improvement of operational performance using existing infrastructure by changing operational objectives and procedures.

A key element of improved performance is simplification. At present too many of the procedures are too complex to manage under current and expected staff and funding levels, and there is greater efficiency to be gained from aiming at better management of more simple procedures than trying to implement procedures that are almost impossible to manage.

RECOMMENDATIONS

The recommendations presented in this volume follow the same basic order of the detailed results, conclusions and recommendations of Volumes 2 and 3, as well as the order of the main findings presented in the preceding section in this volume. This is intended to facilitate location of the more detailed discussions, but also follows the logical sequence for recommendations for system, Cabang Dinas, Provincial and National levels.

Throughout the study, and more specifically in formulating procedures for pilot testing, two basic principles have been followed.

1. Improvement of irrigation management does not require large investments.

   In most study sites there is considerable managerial capacity that is not being utilized. That does not necessarily mean that staff are underemployed, but that through changed focus of their activities they should be able to provide more effective management that will result in better system performance.

2. Management can be made more effective if procedures are straightforward and focus on operational requirements.

   Many of the current procedures are complex and require considerable administrative inputs. Many systems appear to be administered rather than managed in the sense that fulfillment of routine tasks takes a large share of staff time. By simplification of procedures and development of more responsive management inputs it is possible to greatly improve performance with no major expenditure or staff retraining.

The majority of recommendations refer to specific actions that should result in more efficient use of existing resources with little additional cost involved. They should all be able to be included within budget levels already proposed. Some of them, taken in isolation, may appear relatively trivial but they are designed to be part of a systematic approach to management.

Where the recommendations involve expenditure, the costs involved are relatively small, and can be covered from existing budgets if existing financial allocations are modified in an effort to focus on priority issues for irrigation management.

Although not specifically included in IIMI's overall scope of work, the final set of recommendations refer to wider issues that have direct relevance to improving irrigation management in Indonesia.

VOLUME 2

EFFICIENT IRRIGATION MANAGEMENT

The main conclusions of the study on Efficient Irrigation Management are that major improvements in irrigation management can be obtained through more effective use of existing resources, and that there is a need to simplify many existing operational procedures to make them compatible with existing management resources and capacities.

One overall observation that needs to be stressed is that the recommendations are designed to complement the major programs in improvement of irrigation operation and maintenance, and should not be seen as an alternative approach.

However, one particular concern arising from this study is that many of the current activities in the O&M sector loans are geared to re-establishing physical capability so that systems can be operated as designed. This approach has to be questioned insofar as there is plenty of evidence that existing procedures are too complex, and that they continue to rely too much on assumptions rather than actual information about conditions in irrigation systems.

Operational objectives have to change over time: the physical, agricultural, social and economic environments constantly evolve, and it is necessary for irrigation management to change to reflect this evolution. Further, assumptions made in the initial design about staffing, financial resources may no longer be valid. Even with the introduction of irrigation service fees it is unlikely that budgets of irrigation operation and maintenance will significantly increase. As a result many of the recommendations presented here aim at simplification and cost-effectiveness rather than assuming that financial resources will automatically be available to support the most desirable technical operational procedures.

It is hoped that the recommendations will be viewed as sets, although implementation of each in isolation would have some impact. In some cases. however, the recommendations should be viewed as a progressive sequence, with simpler and easier recommendations suitable for early adoption while others can be phased in over time.

Given the diversity of irrigation systems in Indonesia, as well as those studied in detail as part of this Technical Assistance, some of the recommendations will not be relevant to the needs of a particular system, Cabang Dinas or Province. Nevertheless, the intention is that the overall approach presented is sufficiently consistent to enable the relevant recommendations to be extracted and implemented.

Section 2

INFORMATION BASE FOR EFFECTIVE IRRIGATION MANAGEMENT

The degree to which water can be used effectively is highly dependent on the accuracy of basic information about the irrigation system and the condition of existing measuring facilities. There is little utility in measuring some parameters with a high degree of accuracy if data on others is unreliable.

In order to improve the basic information base, the following recommendations are made:

1. Initial efforts to improve data bases at system level must concentrate on those categories of information where there are likely to be the largest deviations between assumed and actual values. Field evidence suggest that the key categories are:

   - determination of actual tertiary block areas;
   - conveyance loss data in main and secondary canals;
   - determination of the location and magnitude of suppletions; and
   - recalibration of measuring structures.

2. Each Cabang Dinas should plan to undertake training of field staff so that the activities undertaken in the BMIP program (Section 3) can be implemented.

3. The updating of basic system information should be treated as an on-going activity, and not as a special project. It does not need to be a full-time activity, but should become a regular part of each month's tasks for field staff.

4. Basic information collection should initially focus on the larger gaps, and then utilizes monitoring data to identify where there appear to be the largest differences between target and actual requirements.

5. Cabang Dinas and Ranting staff should use the updated data irrespective of the values existing in the buku pintar, and should be willing to modify their own forms to incorporate additional information generated from the upgrading of basic information on system conditions.

6. Collection of basic information should not require additional funds as the activities undertaken in this study show that they can be accommodated out of existing budgets. However, the Cabang Dinas may need to reallocate some funds, and to reassign some duties to help in basic collection activities.

Section 3

MANAGEMENT INFORMATION PROJECT PILOT TESTING

The primary recommendations for the management information procedures are: following:

1. Since the management information procedures are low cost, uncomplicated methods which can be applied by local field and office staff and have the potential for significantly improving the information base required for the Factor K system, they should be considered as an essential aspect of more efficient O&M. Policy decisions need to be made to adopt the procedures.

2. Funds and staff resources should be allocated to implement the MIP procedures first throughout the AOUs, and then in other systems with higher technical and management capacity. Attempts should be made first to fund MIP procedures through routine O&M budgets. If this proves inadequate, then loan funds (EOM) could be used.

3. If it is decided to disseminate the MIP procedures more widely, then minor improvements need to be made in some of the forms, techniques, and guide book. Also improvements in the portable weir need to be made as well as identification of alternative calibration equipment and staff gauge design.

4. A short guide needs to be made and approved by DOI and PRIS for how to incorporate information obtained from the MIP activity into the standard operational procedures. Information on block sizes and conveyance losses should be made complete for an entire system before incorporation into the routine O&M information base.

5. Added emphasis needs to be placed on use of the improved information for monitoring and correcting management performance, especially using such indicators as the "delivery performance ratio". A method and supporting form for this needs to be developed.

6. The WUA needs assessment survey needs to be further refined and the form altered to record and schedule assistance plans. It will then become a useful tool for helping PRIS to improve its capability to assist in the strengthening of WUAs in a more functional way based on local O&M problems.

7. Attention, partly in the form of research and field testing, needs to be given toward identifying alternative management systems which are simpler than the current Factor K procedures, requiring less expensive infrastructure, information and flexible control. Field testing could be done in pilot areas, perhaps off Java, where management capacity is more limited.

Section 4

IRRIGATION SYSTEM OPERATION

Improving irrigation operations requires improvement not just in the operation of gates but in the supporting processes of monitoring, evaluation and maintenance. It also requires clear system objectives, and a set of well developed contingency plans when expected conditions are not achieved.

A well-managed system is characterized by a combination of flexibility that allows response to local conditions but still maintains the overall objectives of the operational plans drawn up in advance. Under these conditions monitoring and evaluation are critical to ensuring that flexibility does not deteriorate into uncoordinated and unplanned activities that undermine the ability of farmers to make the best use of available water.

The following recommendations are made in respect of System Operations:

Daily Gate Operations

1. Gate keepers must be provided with clear operational procedures that meet overall system objectives without having to wait for specific instructions from irrigation inspectors. The standing orders have to cover such areas as maintaining equity between different canals irrespective of their size, avoiding over-irrigation, how to respond to rainfall, and how much water to allocate between different gates at different levels of discharge upstream of each structure. They also have to be provided with rating tables to enable them to measure discharges and report daily performance.

2. To cope with unavoidable variations in discharge, it is not appropriate to rely on target discharges for gate operations. Instead, it is necessary to provide gate keepers with instructions on how to allocate water at different discharge levels. Normally high, medium and low discharge conditions would be sufficient, with each discharge level having a specific set of instructions on how to distribute water between the different gates at a single structure.

3. Irrigation inspectors must ensure proper coordination between gate keepers along a single reach of canal to avoid cases where independent actions result in surplus or deficit conditions at the tail. They must take the appropriate actions to modify discharges into secondary canals to accommodate changes in demand in different tertiary blocks along a secondary. However, they should be allowed more flexibility in allocating water between their tertiary blocks as long as they do not take more water than is allocated to them by the system plan.

4. System managers should focus their attention on operation of the main canal system to ensure that variability of discharge is as low as possible, and that allocations of water to secondary canals and to the head boundary of each irrigation inspector are kept according to the system plan.

Monitoring

5. Reporting of Delivery Performance Ratio (DPR) should be undertaken on a daily basis as the primary monitoring of water allocations. An initial objective should be to keep DPR within a range of 0.75 to 1.50, with emphasis on the major allocations of water along the main and secondary canal system.

6. Where regular monitoring shows consistent and significant deviations between planned and actual conditions at tertiary block level, the irrigation inspector must determine whether this is the result of poor operation of gates or whether it reflects a genuine response to local water requirements. If it is due to poor gate operation, then the gate keeper must be required to fulfill his activities more conscientiously. If DPR variations reflect genuine differences from the plan, then the data base for that area probably requires upgrading, BMIP type activities are required, and overall targets should be modified.

7. If the data base is changed, the modified data must be reported to the system manager and used in all subsequent determinations of target discharges. Updating the system-wide data base should be viewed as a regular activity, not one undertaken at long intervals.

Evaluation

8. Periodic evaluation is required to determine whether the current operational plan is meeting the overall system objectives, and whether all parts of the system are being given equal treatment.

9. Evaluation should focus initially on the performance of main canal operations, discharges to the head of secondaries, and water allocations between the different irrigation inspectors. If these conditions are reasonable, then the next stage of evaluation is to determine the equity of water allocation by each irrigation inspector. Only if irrigation inspectors can demonstrate that they have allocated their water fairly and in accordance with the system operational plan but that it is insufficient should changes be made to overall system-wide allocations of water.

10. Evaluations should be undertaken after each season so that there is a chance to make modifications to overall operational strategies before the same season in the following year. These evaluations have to involve farmers, preferably through WUA, as well as internal assessment of performance by irrigation staff.

Maintenance and Repairs

11. Priorities must be drawn up for maintenance and repairs in each system based on their importance for operations and not on the degree of physical disrepair. The system operational plan should provide the basis for a planned and coordinated maintenance plan.

12. For structures, priority must be given to control and measuring devices along the main canals, at heads of secondaries and at irrigation inspector boundaries so that the system-wide water allocations to each irrigation inspector can be implemented and monitored.

13. Priority for lining of canals must be based on measurements of conveyance loss to determine where maximum benefits can be obtained.

14. Desilting of canals must be focussed on those locations where sedimentation is preventing proper control and allocation of water, and where monitoring activities indicate that proper water allocation cannot be achieved even though target discharges have been met at the head of the canal.

15. Farmer involvement in secondary and main canal maintenance activities should be made more systematic. Where possible it should be based on fixed agreements between farmers and irrigation staff, and financial or other incentives provided for their participation.

16. Maintenance programs should be based at Cabang Dinas level rather than at system level to ensure that scarce funds are used most effectively. Many of the repair functions can also best be handled by the Cabang Dinas, while regular maintenance should be organized at system level.

Institutional Support

17. It is essential that the boundaries between irrigation inspectors are rationalized in order to implement system operational plans. There must be a gate and a measuring structure at every hand-over point so that irrigation inspector can determine whether they have received their allocated share of water, and this can be checked by system managers.

18. Irrigation inspector boundaries should be redrawn so that control over water along a single stretch of canal is the responsibility of a single person, and is not unnecessarily sub-divided. It is particularly important to keep main and secondary head gates under the control of as few irrigation inspectors as possible.

19. In redrawing the boundaries of irrigation inspectors, the workloads should be kept as equitable as possible, should minimize and rationalize the number of hand-over points, and should take into account the proposed rotational irrigation plans when coordination is just as important.

Operational Planning

20. While target discharges are essential to the system operational plan, a clear distinction has to be drawn between target discharges and operational activities when water supplies at the head of the system are significantly different from expectations. The operational plan has, therefore, to have a planning component and a set of instructions on how to manage gates at different discharge levels.

21. Target discharges should only be recalculated three times a season: once for land preparation, once for normal irrigation and once for the period before harvest. This simplifies operational coordination, and does not result in significant loss of efficiency.

22. Target discharges should be primarily aimed at the level of irrigation inspectors and secondary canals, not at tertiary blocks. It should be the task of irrigation inspectors to determine how to distribute water between tertiary blocks from the basic allocation made to them. However, the system operational plan should give general targets for expected discharge to each tertiary that can guide irrigation inspectors in day to day water allocation tasks.

Section 5

ROTATIONAL IRRIGATION

Rotational irrigation is particularly important because it is in this period that loss of production is most likely to occur. Irrigation staff therefore have a greater responsibility to try to allocate and distribute water as fairly and as reliably as possible.

During rotational periods it is no longer possible to meet all crop water requirements. Instead, each part of the system is allocated a share of water based on time rather than volume. Consistent implementation of rotational irrigation over several seasons is an effective way to build farmer confidence even when water is in short supply, and encourages them to make effective use of scarce water for crop production, particularly for higher value crops that may be more sensitive to water stress.

The following recommendations are made in respect of rotational irrigation.

Objectives of Rotational Irrigation

1. Each system must have a clear statement of objectives to be achieved during water short periods when rotations have to be introduced. These must specify the type or types of rotations to be adopted, and the equity objectives inherent in those rotations.

2. Wherever possible, rotations should be based on total irrigable area so that all areas of the system have an equal right to water. Where this is not possible because of conveyance constraints, rotations should be planned to allow for equity to be achieved over two seasons, with certain areas only scheduled for a dry season crop in alternate years.

3. Experience of existing rotational irrigation plans must be assessed to determine whether equity objectives are being satisfied, whether the plan is implementable by irrigation staff, and whether it is leading to more intensive dry season agriculture.

Planning

4. A clear plan for rotations must be drawn up that specifies when rotations have to be introduced, the daily schedule of irrigation deliveries and the boundaries of each rotational area. This plan has to be approved through consultation with farmers and village leaders so that everybody is clearly aware of what will happen.

5. The plan must clearly specify equity objectives, and should be valid for several years without major modification to guarantee tail end farmers sufficient water for partial cropping, and encourage them to plant areas that have in the past been left fallow because of uncertain water deliveries.

6. Where water conditions are suitable, it may be possible to have a progressive rotational plan: rotation between tertiaries along secondaries when water supplies are in moderate deficit, and rotation between secondaries when water supplies are severely in deficit.

7. **The plan must minimize the complexity of implementation.** It should ensure that the boundary of each rotational area is at a gate, not at stop logs, that canal sections are not drained and refilled more than necessary, that excessive travel time be avoided, and that head end areas are scheduled for weekends when management inputs are likely to be lowest. Wherever possible, areas irrigated simultaneously should be contiguous, and the number of gates requiring operation to implement the rotation should be minimized. Gates should normally be either fully open or fully closed to make implementation and supervision easier.

Implementation

8. Based on past experience with conveyance of low discharges and the hydrologic characteristics at the system intake, each system should specify the conditions at which rotations will have to be introduced. Systems with long canals may have to introduce rotations when faktor-k is still relatively high to avoid water shortages in tail end areas before rotations start. Small systems may not need to introduce systems until water levels are lower.

9. Once rotations are introduced the agreed plan should be rigorously implemented. This requires frequent monitoring by irrigation staff and must involve farmers in implementation and monitoring. Schedules must be clearly displayed, and use of flags or other markers to identify scheduled areas should be used, to encourage self-policing of water distribution..

10. In cases where progressive rotations are planned to cope with different levels of water availability, the change from one rotational plan to the next must be given in advance so that there is no confusion.

Section 6

MANAGEMENT ACTIVITIES BEYOND SYSTEM BOUNDARIES

Irrigation management is not merely confined to management of water within the boundaries of a single irrigation system. Most systems depend to some degree on the overall allocation and distribution of water along rivers, and rely on the planning processes to determine relative allocations to each system.

At the same time there is a need for coordinated operations along rivers and from reservoirs to provide stable and reliable water conditions at the head of each system sharing a common water course.

Annual and Seasonal Planning

The following suggestions are meant as material for discussion. It is recognized that there may be additional considerations other than those included herein which would effect judgement in these matters. It is apparent that a number of improvements could be made in the process. However, there is rationale for inviting a more fundamental review of the objectives of the annual plan and the proper roles of the parties involved.

1. There should be three seasons in the plan, rather than the current two seasons, because of the now widespread occurrence of three planting seasons in many parts Java and Bali and elsewhere in Indonesia.

2. There need to be March and July meetings of the irrigation committee at the district level to discuss the plan and possible revisions due to more recent information available on weather and supply predictions at the outset and during dry season. The committee should review last year's differences between the planned and actual targets in order to have a better mechanism at this level for making future adjustments.

3. At least one annual meeting of WUA heads and/or village agriculture officers should be conducted per irrigation system or rivercourse management unit, at the subsection office immediately prior to dry season to discuss the crop plan, system and block-level water allocations and rules for adjustment should shortages occur. Irrigation rotation plans can also be discussed in the meeting. The meetings should be based on hydrologic or management units and would aim at coordination between WUAs and dissemination about the plan and agreed revisions.

4. The official block and system irrigation design areas either should be revisable or not be used for planning and distributing irrigation water. The functional area should be used instead and be revised yearly. The functional area should be used both for the annual plan process and system operations and should not be related to PRIS budgets.

5. PRIS should initiate a routine program at the section level to take temporary stream flow estimates in dry and rainy seasons in suppletions or other unmeasured water sources which are used in irrigation systems, roughly calibrating water depth with approximate discharges.

6. DOI and PRIS should obtain better or more complete information on palawija crop water requirements, especially for higher water consumptive crops such as shallots. Certain of these should be given a special designation as unpermitted palawija crops. Standard information needs to be disseminated throughout PRIS about which palawija crops are high versus low water consumptive crops.

7. More fundamentally, discussion and adjustments should be underway in the direction of both simplifying aspects of the plan process and related operational procedures. Furthermore PRIS should restrict its role more to that of a supplier of irrigation water. It will be more efficient and effective if it focuses on acquiring, estimating, communicating, monitoring and delivering water supplies. PRIS should not have as its responsibility trying to get farmers to plant certain crops or planning and delivering water primarily on the bases of actual crops in the field regardless of the plan or supply. Such a simplified, restricted role for PRIS in the annual crop plan might have features such as the following:

   - PRIS may not be very good at closely predicting water supplies in a variable way from year to year (no one is), but it could develop a "Minimum Supply Prediction" (MSP) for each system as a standard guideline to follow perennially, based on historical supply averages and minimum frequency acceptable drought risk. The MSP would usually be the same from year to year, but could be revised occasionally due to long-term weather changes or better information and ability to approximate seasonal supply averages.

   - The MSP would set the parameters for deriving a standard block-level "Minimum Allocation Prediction" (MAP), which would be a standard, estimated minimum likely allocation to be available for given seasons, from year to year. The MAP would be most important for the first and second planting periods of dry season.

   - Within the supply constraints estimated by the MAP any variety of crop combinations could be selected by farmers. PRIS could develop a menu-like set of frequent crop combinations per block (in the form of various combinations of areas per crop types). It might be termed something like the Seasonal Advised Crop Combinations (SACC). A separate SACC would be made for each block per season.

   - The WUA and/or village agricultural officer would be informed of the standard seasonal MAP and have copies of the Seasonal Advised Crop Combinations (SACC) and would use it as a standing guideline for coordinating crop combinations within the MAP.

   - The PRIS would not concern itself with whatever crops are actually planted in the blocks as long as their irrigation requirements do not exceed the MAP, as delineated by the SACC. The PRIS would hold meetings with WUA representatives prior to both planting periods of dry season and PRIS would remind WUAs that crop plantings must fit within the MAP as indicated by the SACC. PRIS would deliver water according to the MAP, with surpluses being distributed proportionately among blocks.

- Under water scarce conditions where the MAP requirements can not be met for all blocks PRIS and the WUAs would have two basic choices. It could either initiate timed irrigation rotation or it could assign standard versus priority designations to blocks. The latter option somewhat resembles the golongan system. All blocks would take turns between years receiving block water priority designations, between two levels (only two so as to remain simple), called priority or standard, for a given dry season.

- Priority blocks would be given prior guarantee to ensure the MAP is delivered as long as the Factor K remained above a level where all priority blocks could be given their MAP delivery. If the supply dropped below this level, a rotation would begin, but still giving priority to the priority blocks. Standard blocks would be given residual deliveries after the MAP was ensured for priority blocks. The standard versus priority designations would rotated automatically from year to year. Efforts would be made to ensure that WUAs, village officers, and all farmers would know what the block water designation is each year. However, the total area in priority blocks should not be so large (it may only be a third of the system during a given dry season) as to cause standard blocks to go fallow.

- This would eventually become common knowledge and could have the following beneficial effects, it should:

  1) help farmers to better assess risks and enhance household-level planning for renting and labor arrangements,

  2) provide all blocks with an annual priority status, so that farmers would have the opportunity, incentive, and security to periodically take the risk of investing in higher value, higher water-consumptive crops during their priority seasons, thereby enhancing equity,

  3) farmers would know well in advance when their priority years are and could save or prepare to invest in higher value crops beforehand,

  4) it should increase the system-level overall high value crop production over time.

- Such an approach would leave the agriculture service with the task of trying to persuade farmers to plant certain crops, in accordance with national and provincial targets and within the parameters of the MSP and MAP. The agriculture service would have in their possession the system-level MSP and block-level MAP and SACC as standing guidelines within which they work out favorable crop combinations. This should not be PRIS's business. Agriculture would use the SACC as a menu and work out actual crop combinations with the farmers.

- Under such a scenario the annual crop plan process would not require annual reports from the farmers up through PRIS to the Section level concerning crops planned for the coming year. It would be sufficient for PRIS to keep the agriculture service and local government informed of the MSP, MAP, and SACCs, and of adjustments to them. PRIS would focus on estimating, communicating, and delivering the MSP and MAP.

Rivercourse Management

Public Works has the responsibility to coordinate water use along rivers. although this study is not concerned directly with water resource planning, it is clear that even as far as irrigation use is concerned there is a need for more coordination along rivers. It is just as important to maintain stable and reliable water conditions at each weir along a river as it is to provide reliable and stable water conditions along irrigation canals.

The following recommendations are made in respect of rivercourse management:

1. It is essential that all water extractions from a single river are fully coordinated within hydrologic boundaries, and not based on administrative boundaries. There must be full consideration of demand for irrigation water together with other non-irrigation uses from a single river as part of a coordinated plan.

2. For effective management along a river it is important that clear operational objectives be developed that specify rights to water and the relative priority of access when water is in short supply. These objectives must define whether all systems along a river have a right to an equal share of available water, or whether certain systems have legitimate and established priorities.

3. All weir operators along a single river must have specific standing orders that instruct them on how much water can be extracted at any time. These orders should be based on the upstream discharge at their weir, and ideally provide instructions for high, normal and low discharge conditions. For each condition the weir operator would have specific targets for discharge into the irrigation canal that would reflect the allocation to that system and still maintain downstream target discharges.

4. Where objectives provide for water allocations for several systems but water is not sufficient, rotations between weirs should be introduced. These rotations would call for closing of irrigation canals for a set number of days each week and all discharge would pass to downstream irrigation systems.

5. Irrigation inspectors should improve monitoring of discharges at each

weir to ensure that standing orders are being followed so that conflicts between weir operators are reduced.

6. Cabang Dinas staff have to develop standing orders for each weir that will fulfill the overall operational objectives, provide proper supervision of irrigation inspectors, and maintain a seasonal evaluation that assesses the extent to which the overall operational plan was implemented.

7. In cases where a single river passes through more than one Cabang Dinas or Wilayah coordination must be improved, and target discharges set at the boundaries to ensure that all areas receive their allocated share.

Reservoir Operations

Where reservoirs have been constructed there are several specific-advantages for irrigation management. Water from the wet season can be saved for dry season use, discharges can be regulated to provide more stable water conditions at downstream weirs, and planning is made easier because water availability is better known before the start of the dry season.

The following recommendations are made in respect of reservoir operations:

Operational Objectives

1. Wet season operations should be aimed at providing a minimum level of storage at the start of the dry season, normally the maximum capacity less any reserve for purposes of flood control. Dry season operations should aim at a minimum storage to be maintained at the end of the irrigation season to cater for other uses such as domestic supplies or minimum river discharges.

2. Wet season releases should be reduced whenever rainfall is sufficient to meet crop water requirements: this reduces over-irrigation, conserves productive water in storage for the dry season, and reduces the risk of flooding in low-lying areas. Generally releases should be stopped if rainfall exceeds 50 mm in three days.

3. Dry season releases should be matched to total irrigation demand over the entire season, and not slowly decline through the season because crop water demands normally increase as the dry season continues.

4. Releases should be made so that discharges into rivers or irrigation canals are as stable as possible, thus easing the task of managing the irrigation system.

5. If rainfall is lower than expected or storage is declining too rapidly,

releases should be reduced sufficiently early by a small amount rather than waiting so long that suddenly water supplies are well below irrigation requirements.

6. Where possible, simple rainfall-inflow relationships should be determined to provide information on whether inflows are likely to be above or below predicted levels. These provide a guide to system managers in determining whether water availability is likely to be higher or lower than planned.

Planning

7. Existing data on storage, releases and spills should be analyzed to determine probable inflow in each 15 or 30 day period, and the probable storage before the start of the dry season, so that seasonal planning can be based on the best data available.

8. Given probable dry season inflow, probable rainfall, and storage at the start of the dry season, the total likely water availability for the dry season can be calculated and used in the annual planning process. The planning process should be based on the entire command area of the reservoir rather than using administrative boundaries.

9. Irrigation systems served by reservoirs should have revised dry season operational plans based on storage levels shortly before the dry season is due to start so that the area scheduled for irrigation is directly linked to the availability of water. It should be possible to hold such meetings as little as one month before the dry season commences.

Section 7

ALTERNATIVE MANAGEMENT OPPORTUNITIES

Although there is considerable scope for improving management by modifying existing procedures, providing simpler and more manageable operational plans, and modest reallocation of workloads, it is also important to consider alternatives that provide potential long term benefits.

As agricultural, economic and social conditions change it is important that irrigation management activities are able to respond so that policy objectives can continue to be fulfilled. If irrigation management becomes static then it is likely to become out of touch with contemporary needs and requirements, and lead to less effective performance.

The following recommendations are made in respect of new management opportunities:

Short Term Operational Objectives

1. A simpler method of water allocations needs to be developed to minimize office based calculations of targets, and maximize the time spent in managing water in the field. This should involve determining target discharges for three conditions: land preparation, normal irrigation and harvesting periods, and allocating water to each irrigation inspector.

2. System managers should focus on providing stable water conditions in main canals and at the head of secondaries, and ensuring that water allocations between irrigation inspectors are equitable. This represents the wholesaling function of irrigation management which is a hydraulic function that is not immediately concerned with short-term response to agricultural conditions.

3. It is at the level of the irrigation inspector that water allocation has to reflect short-term demand. The responsibilities of the irrigation inspector have to focus on equitable but needs-based allocation between tertiaries, and ensuring that transfer of water to the next irrigation inspector downstream is in accordance with the overall plan. This requires giving greater managerial responsibility to irrigation inspectors because they have to determine local requirements.

Long Term operational Objectives

4. System-wide water allocations should be changed from the present inequitable system, based on current cropping patterns, to one that uses irrigable area as the basis for allocation. This will permit greater access to water for tail end farmers, and facilitate more systematic use of water throughout the entire irrigation system.

5. Ultimately farmers decide on what crops to grow. To facilitate their decision-making the focus of the wholesaling function of irrigation staff is to provide stable and predictable water deliveries that foster confidence of farmers so that they can invest more in agricultural production. The need for reliability and predictability is just as important under normal conditions as it is in water short periods when rotations are required. The operational objectives of irrigation staff should be to guarantee wholesale allocations of water, and allow farmers either at tertiary block level or as a group along secondaries to decide how best to use this water for agricultural production.

Modifying Design Guidelines

Current design guidelines do not take sufficient account of operational objectives or operational conditions in typical irrigation systems.

It is not sufficient to assume that operational duties will merely follow the design, but to have a clear idea of operational conditions before designs are finalized. Areas that require improvement include the following.

6. Gate widths must be carefully matched to irrigable area of each tertiary so that gate operations become simpler. Although this does not have to be exactly proportional, there is no reason not to rationalize the current situation where gate widths do not bear much relationship to irrigable areas.

7. Where possible, sill levels of all gates should be made uniform, and gate design should be made uniform, so that gate keepers can more easily manage water when discharges are changing on a daily basis.

8. In determining where control and measurement devices should be located it is essential to consider operational conditions. This means that design engineers must take account of the expected boundaries of irrigation inspectors, and include appropriate control and measurement devices at those locations.

Changing Design Standards

A basic assumption in the EOM and AOU programs is that if systems are upgraded they can then be operated as they were designed to be operated. However, many of the results of this study indicate this assumption may not be correct, and that changes in design may be required to meet changed financial and managerial expectations into the future.

The aim of changing design standards is to develop simpler designs that are easier to manage and still meet the overall objectives of delivering water in as equitable and reliable manner as possible to foster improved agricultural production.

9. Pilot design and field testing of proportional division should be tried out in an existing irrigation system. Tertiary gates should be sized to the irrigable area and provided only with sliding gates to facilitate rotations in water short periods. At all other times water allocation would be in proportion to the irrigable area.

10. Widths of main and secondary canal gates should be matched to the irrigable area, and provided with measuring devices, so that the share of water to each irrigation inspector can be maintained irrespective of the actual discharge being delivered to each gate.

11. The elevation of all gates at each structure has to be the same so that proportionality is maintained irrespective of upstream discharge.

12. A progressive rotational plan be developed that allows for rotation between tertiary blocks using the tertiary sliding gates when water supplies are in moderate deficit, and rotations between secondaries under water short conditions.

Implementation of Special Maintenance and Rehabilitation

A clear sequence of activities must be followed to make the most effective use of funds reserved for special maintenance or rehabilitation. If physical improvements are random and unrelated to operational objectives it is unlikely that physical improvements will result in significant improvements in performance.

It is therefore essential that operational plans be developed prior to any investment in physical repairs or upgrading, and that physical work be viewed as an integral part of operations rather than a special project.

As a basic principle, physical improvements should be earned through demonstrated effective use of existing facilities up to the limit of their capability rather than rewarding poor performance with physical improvement.

13. The first stage must be to improve existing operations within the limits of existing physical infrastructure, and identify the key physical constraints to further operational improvements. Identification of physical improvement based on inspection of physical condition alone should not be sufficient grounds for investment in new facilities.

14. Where revised operational plans cannot be implemented due to physical constraints, physical improvements must only be made at key structures that are essential to maintain operational control over water. Normally this essential work will be at main and secondary canals level only. The remainder of work should be phased when financial resources permit.

15. Priorities for physical work must be at Cabang Dinas level, not at system level, to ensure that the most effective use is made of overall budget allocations. However, the relative priority of physical work has to be based on operational plans developed for each system.

Section 8

NATIONAL AND PROVINCIAL SUPPORT FOR IMPROVED IRRIGATION MANAGEMENT

Indonesia is currently undergoing major changes in the O&M sector with the provision of large amounts of external support in the form of sector loans. Although IIMI has not had a specific mandate to address these issues, it is appropriate to make a few recommendations related to overall direction of irrigation management activities.

Given that irrigation management is a provincial task rather than a national one, the focus of national support to provinces should be advisory and account for the different conditions and objectives in each province.

1. In the more important Provinces it is essential that different packages of the World Bank and ADB sector loans be implemented in parallel. Specific areas where interactions should be sought are between turnover, institutional strengthening, efficient O&M and irrigation service fees because goals of increased farmer participation, increased farmer payment for water and greater emphasis on Provincial, Wilayah and Cabang Dinas financial self-sufficiency all coincide.

2. There is a clear need to de-link physical investments from improved management of irrigation systems. Unless the operational objectives and plans for systems improved, there is little likelihood that further physical investment will result in improved performance. Investments such as Special Maintenance must be not only based on a Plan of Operation and Maintenance that determines priorities for such investments, but should be linked wherever possible to proven operational performance. This is true for both large systems and those scheduled for turnover.

3. Efforts must be made to determine suitable rewards or incentives for demonstrated improvements in performance. Incentives should take the form of a percentage of irrigation service fees collected, or developing a greater variety of rank within a single job category so that promotion can be based at least in part on work performance rather than length of service.

4. DGWRD and Provincial Departments should make use of comparative measures of system performance that facilitate evaluation of the effectiveness of irrigation management between different systems. Current measures tend to be weighted towards general agricultural parameters such as cropping intensity, and do not reflect either the effectiveness of current operations, or the degree to which water has been properly allocated in the main and secondary canal system. There is a need to assess how well the hydraulic function of irrigation is being undertaken by engineers as well as assessing overall agricultural performance.

5. A clearer distinction must be made between the wholesaling function of water allocation and distribution along rivers, in main and in secondary canals, and the distribution of water between and within tertiary blocks. The closer involvement of Water User Associations both within tertiary blocks and along secondaries must be actively sought because there are unlikely ever to be sufficient resources or managerial capability for Public Works to undertake the full range of both wholesaling and tertiary distribution activities.

6. To assist Provincial Departments in improving irrigation management, DGWRD must provide a more effective advisory service that assists Provinces in learning from experiences elsewhere. There are clear signs that Provincial Departments and their consultants are unfamiliar with experiences in the same sector loan package in other areas. In some Provinces there are several different consultants working on different activities, and this creates additional difficulties for Provincial Departments because there are sometimes conflicting objectives involved in the different activities.

7. Within DGWRD there needs to be a stronger institutional basis for development of irrigation management support services that is separated from the time consuming work of project implementation. Under current arrangements it is difficult for DGWRD to find sufficient time to consider issues of policy implementation and development of support for provinces because too much time is spent in project completion. The initial moves towards establishing a central body dealing with irrigation and drainage management need to be vigorously pursued.

8. In providing an effective advisory service, however, DGWRD must avoid attempting to impose standardized operational practices. It is sufficient to try to provide overall guidelines for objectives, because ultimately system operational plans will all be different because of differences in physical, agricultural, social and economic environments.

THE SMALL SCALE IRRIGATION TURNOVER PROGRAM

MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

1. IIMI's Role in the Turnover Program

The IIMI study team has focused on the four following topics: 1) the nature of Provincial Irrigation Service (PRIS) investment in systems and farmer dependency on the PRIS prior to turnover, 2) monitoring and assessment of the turnover process, and 3) organizational implications of turnover for PRIS sections and 4) the prospect for long-term sustainability of the small systems.

1) Nature of PRIS and Farmer Investment in Systems and Farmer Dependency on the PRIS Prior to Turnover - The study team has assessed the nature and extent of PRIS investment in irrigation systems which are eligible for being turned over. Such investment includes construction, rehabilitation, repairs, routine maintenance and water distribution. The intent was to provide insights into both the nature of farmer dependency on the PRIS and the degree to which turnover will actually decrease the O&M burden on the farmers.

2) Monitoring and Assessment of the Turnover Process - The nature and effectiveness of agency/farmer/turnover officer (TO) interactions at the field operations level during the turnover preparation phase has been monitored in selected irrigation systems. Recommendations are provided on the national and provincial working groups regarding how to improve various aspects of the process, both for the pilot areas and for the national turnover program.

3) Organizational Implications of Turnover for PRIS Sections, Farmers and Water Users Associations - The implications of the turnover process for the allocation of financial and staff resources at the pilot section and subsection levels have been analyzed. The current work loads and implications for staff reallocation have been examined in the pilot areas.

4) Prospects for Long-term Sustainability of Small-Scale Irrigation - Several sample systems in the Stage I of the turnover program were monitored on a monthly basis to evaluate levels of farmer investment and the physical condition of the systems over time. This also provides a basis for comparison with conditions after turnover.

The Government of Indonesia has selected two PRIS sections for the turnover pilot project: the Sumedang section in West Java (approximately a one-hour drive from Bandung, the provincial capital) and the Solok section in West Sumatra (approximately a one-hour drive from Padang, the provincial capital). The primary consideration in selecting these sections was the large number and high locational density of small systems in these areas. Within these sections the IIMI/PRIS study team collected data at the system, subsection and section levels, monitored the turnover process in eight sections in West Java and West Sumatra, and monitored water management performance in 13 small systems undergoing turnover.

The study team consisted of: 1) Dr. Douglas L. Vermillion as principal researcher for turnover study and assistant team leader for IIMI's Indonesia Country Program (IIMI Irrigation Management Specialist), 2) Dr. Ganjar Kurnia as research coordinator for West Java (and lecturer in rural sociology at Padjadjaran University, Bandung), 3) Agus and Utar (seconded to the study from the PRIS, Sumedang section) as field observers in West Java, 4) Helmi, MSc. (lecturer at Andalas University) as research coordinator for West Sumatra and 5) Refdinal (lecturer at Andalas University), Fauzi (direct hire), and Amrizal (seconded from PRIS, Solok section) each as field observers in West Sumatra.

2. The Importance of Managing Turnover According to its Objectives

The study team has based its recommendations mainly on acheiving officially-stated Government of Indonesia objectives of the turnover program. The stated basic components of turnover include the following activities: 1) establishing or developing viable water users associations (WUA, or P3A in Indonesia) in the systems, 2) preparing the WUA to be willing and capable of accepting full responsibility for all O&M roles in the systems, and 3) making needed physical improvements in the systems which are manageable by farmers and which support the long-term sustainability of their systems.

The stated basic objectives of turnover are as follows:

1) An acheive an efficient and effective allocation of O&M resources, in order to intensify water management in larger technical systems, to minimize the need for frequent rehabilitation),

2) Transition to a more indirect, service-oriented approach to assisting small irrigation systems,

3) Develop a more formal, systematic management approach at the inter-system level along rivercourses,

4) Long-term local sustainability of O&M in small-scale irrigation.
Assessments and recommendations have been based primarily on how the PRIS can best acheive the above-stated longer-term purposes. Most recommendations address how the implementation process can be improved in order to meet these objectives.

A variety of very specific activities is underway with rapid dissemination being scheduled in many provinces. Only through continuous guidance by officials in the Directorate of Irrigation and regular supervision and monitoring by heads of the provincial irrigation services can it be hoped that this profusion of activity will be kept subordinate to the basic objectives and purposes of turnover. It is important that activities such as design and construction and formation of WUAs are done in such a way that they are always and at all levels understood and implemented as means to acheive the end objective of locally-sustainable O&M in small-scale irrigation.

3. Summary of Findings

3.1 PRIS and farmer investment patterns

From analysis of national-level O&M budgets it is apparent that turnover will not have a major effect on "freeing up" funds for use in larger systems or on reducing budget demands. However in provinces and sections with high proportions of small systems the effects will be pronounced. From analysis of PRIS investment patterns in the 1980s in the two pilot sections in West Java (Sumedang) and West Sumatra (Solok), we find that average annual total O&M expenses in systems below 150 ha were only Rp. 5,435/ha in Sumedang section and Rp. 2,485/ha in Solok section. The rates increase from between approximately Rp. 7,000 and 10,000/ha for systems between 150 and 500 ha. However the actual distribution of much of the investment is concentrated into a minority of the small systems. In Sumedang only 38 percent of systems below 150 ha had staff (most of which were multiple intake systems, wherein staff functioned in only one of the subsystems). In Solok only five percent of the systems below 150 ha had staff. Significantly, the largest proportion of the O&M budgets in both areas was for incidental repair (either contractual or by direct account), not staff. Turnover of small systems will have a substantial impact on the potential for budget reallocation, unless PRIS continues to play a similar role in incidental repair assistance after turnover.

PRIS is not the sole manager of its systems, so turnover will not mean a transfer of all O&M tasks from the agency to farmers. All systems in the stage one turnover group were either jointly managed by PRIS and farmers or were solely managed by the farmers already (except perhaps for occasional incidental assistance). Internal water distribution and desilting work already tend to be in the domain of the farmers in most locations. Even weirs are often jointly operated, under the supervision of PRIS staff.

Data from monitoring WUA maintenance activities in 13 sample stage one systems in West Java and West Sumatra shows that the level, frequency, and timing of farmer maintenance activities varies dramatically between systems, apparently primarily due to varying management requirements. This is particularly interestingly, in light of the parallel observation that monthly levels of siltation and grass coverage vary during the year (indicating maintenance activity) and in almost all cases the silt levels return to an average level. There is no indication that the systems are deteriorating (in terms of silt or grass), either in the systems with or without PRIS staff.

3.2 Turnover process

Field implementation of turnover only began in February 1988, with the initial inventory of 71 systems in West Java and West Sumatra. It was originally estimated that the turnover process should take less than 18 months. As of October 1989, still no systems had been turned over to the water users associations (WUA), construction was at nearing completion in the 10 stage one systems in West Java (1,207 ha), and contractual construction was just beginning in the stage one systems in West Sumatra. Part of the reason for the initial slowness of implementation is due to the lack of experience. While the approach of "learning while doing" is inevitable, it creates an urgency to learn fast because of the targets which have been set for dissemination. It is expected that by July 1990, 14,400 ha will have been officially turned over. The turnover program expanded to Yogyakarta and Central Java in 1988 and is scheduled to spread to East Java, South Sulawesi, and Nusa Tenggara provinces in the 1989/90 budget year. By 1990 nearly all aspects of implementation will be carried out by the provincial irrigation services (PRIS), including most or all of the training.

Although it is too early to be conclusive, there are reasons to be optimistic about the general direction in which the program is going. There is general consensus about most (but not all) of the basic aspects of the process. The major elements in the process are now nearing formalization, with Ministerial Regulation No. 42 by the Minister of Public Works on turnover of small-scale irrigation (approved on November 8, 1989). Recent legal consultations in Jakarta and West Java indicate that there should be no major legal or administrative obstacles to turning over full O&M authority to the water users associations (WUA). The legal status of the WUA is well-founded, although there is need to test and establish some precedents, such as its ability to own assets, let contracts, and receive credit. Initial reservations about turning over systems covering multiple villages apparently has been resolved.

There are many aspects of the turnover program in Indonesia as it is currently formulated and being implemented which are innovative and appear to have substantial potential for succeeding both in reorienting how the PRIS relates to small-scale irrigation and in preparing the small systems to accept full responsibility for O&M. Field operations personnel (mainly the irrigation inspector) are used in effect as "institutional organizers" on a national scale, rather than attempting to recruit non-agency IOs (which would not be possible in a nation-wide program). Most irrigation inspectors observed in the early stages of implementation appear to be capable and willing as TOs given proper training, operational resources and supervision. In the turnover process, training is segmented into different specific components of the process, rather than being administered all at once. Design and construction is done by first collecting farmer proposals for system improvements, having farmers rank the proposals in order of importance, and then having the TO make a "farmer version" of the design for system improvements. A technical version is then made based on the farmer version and is finally approved by the farmers. In a number of locations the PRIS has demonstrated flexibility and sincere efforts to collaborate closely with farmers in the process. Development of the water users associations (WUA) includes an emphasis on assisting the WUAs prepare functional O&M work plans.

Most irrigation inspectors seem capable of understanding and implementing most aspects of the turnover process, including the preliminary data collecting and assembling, coordinating collection, ranking, and drawing farmer proposals, and talking and planning with farmers in a dialogue form. Many PRIS staff from the province level downward seem refreshed to have a program which invites their creativity and a broadening experience in joint water management. Generally it has been the tender and contract arrangements (with their new kinds of terms of reference requiring WUA approvals), that have caused the initial delays, not the dialogue planning activities with farmers. So it can be expected that as the precedents for such arrangement become established, the process will proceed more smoothly. Considerable flexibility, responsiveness to farmer aspirations, and close PRIS technical supervision has been shown in some areas, such as Sumedang section in West Java, even where construction was done by contract. In short, the turnover process in general has many good and viable aspects. It should be continued and gradually improved as experience continues to accumulate in the field and in PRIS offices.

However, since the program is still new there are many aspects of the process which still need to be clarified, such as: How can a PRIS staff be trained and supervised as a turnover officer to act similarly to an institutional organizer?, What should be the nature of farmer involvement in the physical improvements?, How can the turnover officer identify and effectively work with farmers in preparing for turnover?, How long should the process take?, and so on. There are areas where policy clarification in the process are still needed. Among the more important of these is the need for clear policy statements about: 1) disposition of PRIS staff following turnover (such as, whether or not staff will in fact be moved out of the systems after turnover), 2) whether or not farmer investment in pre-turnover repairs will be required, and if so on what basis and how much? and 3) what should be the basic purpose and scale of special maintenance funds per hectare in design and construction?

There are aspects of implementation that cause concern and need to be addressed. There has been an overemphasis on construction. What little activity to date has been done on strengthening the WUAs has been centered more on formal institutional aspects rather than on functional O&M problems. This has hindered the formulation of a rational process for preparing farmers for new O&M roles, such as identification of O&M problems or preparation of an O&M work plan. There is a danger that the current approach which does not rely on any farmer investment in the systems (all labor being paid), will only increase local dependency on the agency and hinder the development of a local sense of ownership and responsibility. Also, there are aspects of duplication in the process and some potential for streamlining the field activities to make them more oriented toward immediate action.

Supervision and field guidance of turnover officers generally needs to be more intensive and systematic. However, staff and supervisory capabilities are likely to be weaker as the program spreads. Training to date has not adequately prepared turnover officers for some necessary skills, such as making sketch maps, drawing designs of structures, estimating construction costs, how to identify farmer representatives, how to obtain committments from WUA membership about involvement in the turnover process, how to organize meetings and speak before farmers about turnover.

3.3 Implications of turnover for PRIS, water users associations, and water management

National or provincial guidelines and statements of intent on staff disposition and section budgets after turnover need to be prepared and disseminated. Since this has yet to be done and also due to the delay in implementing turnover, it has not been possible to meaningfully assess the implications of turnover on PRIS, in terms of disposition of staff, budgets, reallocation of resources, and adjustments in O&M roles. An assessment of the **likely effects of turnover on management of water supplies between systems** along rivercourses is needed. When the PRIS conduct the preliminary data surveys it will be possible to estimate some of the effects of turnover on staff and province budgets. Although most system-level PRIS staff are non-civil servant status, for social reasons it can be expected that there will be difficulties, and possibly some reluctance, in releasing or transferring staff. However, provinces and sections can assess related indicators such as numbers of staff needing to be transferred and distances from displaced staff houses to the nearest system over 500 ha.

3.4 Prospects for long-term sustainability of small systems

Results from the monitoring of the stage one systems show that all systems are being jointly managed, and that farmers already are heavily involved in operations and maintenance. None of the systems observed appear to be in a process of decline. And while the levels of farmer management intensity vary considerably, this appears to be related to the differing levels and kinds of local management needs. In a few of the systems undergoing turnover, farmers have already begun discussing what new WUA tasks and staff will be needed after turnover and what the new level should be for the WUA water service fee. They are often being told by turnover officers that the PRIS staff would leave after turnover. It is likely that where farmers are convinced that they will have to take full responsibility for O&M after turnover they will do so, given that livelihoods depend on irrigation and that traditional forms of organization of water management existed widely throughout Indonesia before many such irrigation systems were assisted and incorporated into PRIS. Preliminary indications to date support the optimism that farmers are generally going to be capable to take over full responsibility for routine O&M after turnover. (See Sections 2.4 and 6.3)

4. Synopsis of most important recommendations

The following is a list of what is considered to be the twelve most important recommendations for the turnover program in this report. They are listed roughly in order of perceived importance. References are given for where the full explanation of the recommendations are given in the text.

1) Partial or matching farmer investment in system improvements done with special maintenance funds under turnover should be required to engender

farmers' sense of ownership of the system, willingness to take responsibility for routine O&M tasks and their conception that future PRIS assistance will supplement, not replace, local capacity to invest. (Section 5)

2) Official clarification is needed at the national and provincial levels about criteria, options and intent for disposing of or otherwise dealing with system-level PRIS staff assigned to systems being turned over. (Section 7)

3) The rate of expansion to new provinces should be slowed. However, the rate of dissemination may be faster between sections within provinces due to the greater potential for supervision and overlap in training at this level. (Section 7)

4) Dissemination of turnover within PRIS sections would be more efficient and effective if it were concentrated within subsections and if turnover of systems between 150 and 500 ha were begun simultaneously with systems below 150 ha. (Section 7)

5) Training needs to be improved so as to better reflect the current background and perspective of the turnover officer trainees. Namely, more emphasis needs to be given to specific methods, instructions, and guides for how to implement various tasks under turnover which are new to the turnover officer's experience. Participatory and feedback techniques should be increased, such as more use of quizzes, questions and answers, role playing, and group problem solving. In contrast to what seems to be the case so far, Ttaining should not be based too much on the assumption that the trainee will have the authority, education, intellectual creativity or relatively democratic conditions in the field to act as an identifier and solver of problems and arbitrator between PRIS, villages and WUAs. Attention needs to be given to providing more short but specific and detailed guides as material for training. (See Sections 3 through 7 and Section 8.4 below)

6) The sociotechnical profile should be modified from being primarily a general baseline data collection exercise to one of focusing more on O&M constraints, agricultural objectives, and WUA development. Data collected should be directly linked to impending turnover decisions and activities. WUA development training should be moved up to the profile stage. This will help ensure that the main focus of turnover preparation is on O&M and that construction will be considered a possible means, not a given end. Each construction activity should have to be justified according to an operations, maintenance or productivity constraint, as identified by the users and agreed to by the TO or PRIS supervisor for turnover in the profile stage. (Sections 3 and 6)

7) A local O&M workplan needs to be prepared between the users and the turnover officer during the profile. It may need to be modified after construction. It should be used as a standard for evaluating WUA preparedness, extension needs and the effectiveness of turnover. (Section 6)

8) Supervision and guidance of the turnover officer needs to be improved. This can be done in two basic ways, 1) by giving a formal role to the subsection head for in the turnover process and 2) by the section-level turnover coordinator doing more regular and systematic assigning and checking tasks given to the turnover officers. More SM funds should be allocated to support formal involvement of the subsection head in turnover. (Section 7)

9) Travel and operational expenses of the turnover officers need to be adequately covered so as not to discourage them from having intensive activity in the field and effective communication with the users. (Section 7)

10) A design guidebook needs to be prepared to specify standards, indicate essential TORs for contracts, and suggest design options which are inexpensive and appropriate for farmer operation and maintenance. (Section 4)

11) System inventories should be done all at once in each section so as to facilitate forward planning for dissemination, training and staff allocation which is based on generalized criteria. (Section 3)

12) Continuing monitoring, evaluation, and research is needed. In monitoring this includes construction problems, the O&M transition stage, post-turnover activities including PRIS staff reallocation, training enhancements and WUA development strategies. In evaluation this would include farmer response to construction, comparison of WUA O&M activities, system condition (eg. siltation and grass coverage) and system productivity (eg. cropping intensity) before and after turnover in selected systems. Useful research topics include the nature of water management in large-scale (ie. over 500 ha) systems managed by farmers and the documentation of aspects of traditional irrigation structural designs in farmer-managed systems. (Section 7)

5. List of additional instruments and materials needed

The following is a list of suggested supporting instruments and materials for training and as guides for implementing various aspects of the turnover process. The materials should also aid supervision, monitoring and evaluation. Most of them should be in the form of one to three page guides.

1) Guide for organizing turnover staff and tasks at the provincial level
2) Guide for utilizing preliminary survey data as a planning tool at the national and provincial levels
3) Guides for planning respective turnover training courses
4) Detailed job descriptions and schedule of activities of turnover officers
5) Detailed job descriptions and schedule of activities of section-level turnover coordinator

6) Detailed job descriptions and schedule of activities in the turnover program for the subsection head (kepala ranting dinas/pengamat)
7) General guidelines for interviewing techniques for the turnover program
8) Triangulation method for identifying informants at system and block levels
9) Guide for disaggregating multiple intake systems
10) Guide for making crop pattern sketch maps and calculating cropping intensity at the system level
11) General guidelines for public speaking techniques in village and system-level meetings under the turnover program
12) Guide for conducting proposed open meeting with farmers during profile
13) Guide for preparing AD/ART
14) Guide for forming WUA and conducting related meetings
15) Guide for preparing system-specific O&M workplan, by WUA and turnover officer
16) Guide for conducting meeting to make priority ranking of system improvement proposals
17) Turnover program design guidelines book, which includes inventory of potential traditional or appropriate structures for farmer management
18) Guide for preparing cost estimates of proposed structures
19) Guidelines for the turnover officer to prepare farmer design version drawings which accurately reflect farmer intentions and which are understandable to farmers
20) Guide for conducting meeting to integrate farmer and technical version of design for system improvements
21) Summary of advantages and disadvantages of, and criteria for, using direct force account versus contracts for small-scale irrigation improvements design and construction
22) Guidelines, options and criteria for arranging farmer investment in construction
23) Administrative steps in turnover of O&M, detailing who does what, when and how
24) Example guidelines, options and criteria for planning system-level staff reallocation, disposal, or assigning of new tasks after turnover
25) Administrative steps in turnover of ownership of system assets to the WUA (ie. privatization), detailing who does what, when and how.

6. Complete Set of Recommendations for the Small Scale Irrigation Turnover Program

6.1 The Preliminary Survey and System Inventory

1) Implications of old and new definitions of A systems

Under the old definition, an A system was one in which there was no prior investment by the public works deparment and so was not eligible for special maintenance (SM) construction funds. Under the new definition approved, A systems will also become eligible for construction funds, as long as the system is in need of repair. This will overcome the current inequity problem where only systems already assisted by PRIS would be eligible for more assistance. However the new policy may open the way whereby demands for construction become excessive and capture PRIS's ability to attend to O&M transfer. It could encourage new dependency in systems where no prior dependency on the government existed, particularly if it is PRIS alone which determines whether or not systems need repair. To avoid this it is suggested that: 1) the level of construction funds be kept to the current modest levels, 2) provision of construction assistance be contingent upon a minimum level of unpaid farmer investment (see section on construction investment, below), and 3) demonstration of a management and agricultural performance constraint be provided as justification.

2) <u>Revised purpose of preliminary data survey</u>

A primary reason for this survey was to identify in advance how many systems would be eligible for construction assistance, to aid in planning budgets, this being determined by whether they had had prior public works assistance. With A systems now becoming eligible for SM assistance, the only way to determine the magnitude of demand for SM is in the field. However, data from a preliminary survey is still needed at the national and provincial levels well in advance of the field implementation of turnover field activities in order to help systematize program planning. We suggest that the key data which should be collected in this preliminary survey is: 1) nature of staff in the systems, 2) whether a water users association (WUA) exists, 3) whether there is prior PRIS investment, 4) number of intakes, 5) relative location along rivercourses, and 6) distance of system from subsection office. The data would be recorded at the subsection level and assembled and sent to the province by the section. By having data on numbers of systems, and which systems have staff and WUAs, the Directorate of Irrigation and PRIS will be able:

- to know how long turnover implementation is likely to take in each section and province in order to schedule activities in advance,
- to develop long-term estimates of special maintenance (SM) funds needed,
- to enable estimation of annual turnover budgets (DIP) more closely based on actual needs,
- to know in advance implications of turnover for PRIS personnel and to enable forward planning for staff allocation, and
- to facilitate forward planning of WUA development activities, particularly in cooperation with the public works department training unit and the agricultural service.

3) <u>Streamlining the inventory</u>

Much of the data collected in the inventory is again collected or reassembled, in the profile, usually in more depth. Three more efficient choices exist:

1) Drop the inventory (and use the PU investment survey, TP4 coordinator inspections, and rivercourse survey as alternatives),

2) Keep the inventory, but enlarge it to encompass most of the basic data collection (changing the profile to emphasize planning for turnover in

dialogue with the users, rather than as just a repeat and extention of data collection, as is the case at present), or

3) Reduce the amount of data collected to that of immediate use in the turnover program and avoid overlap between the inventory and profile. The latter option is recommended as long as both stages are streamlined and have independent objectives related to preparation for turnover.

Other IIMI research has shown that data collection of information not of immediate use by PRIS is usually not used for actual management purposes and also quickly becomes obsolete. (See IIMI Phase I Final Report). We assume such is also likely to be the case with the turnover program.

It is questionable as to whether data collection which is not directly related to agency actions will constitute an effective learning experience for agency staff. PRIS field operations staff are used to dealing with very specific and technical tasks and instructions and not making the conceptual links between general sociotechnical information, strategies for gaining social rapport, and institutional and technical development. Data collected needs to be more compartmentalized and more directly linked in the forms to specific outcomes or decisions, such as boundaries of single intake/single management unit systems, whether a system is A or non-A, who the system and block informants are (and how identified) and what kinds of information they can provide, whether the cropping intensity is depressed for irrigation structural reasons, etc. Such more direct linkage between data collected and turnover actions taken will give the data collection more meaning for the turnover officer and be a better learning experience.

4) Essential elements in the inventory

The inventory is the first field activity in the turnover process and as such should be an opportunity for the TO to become acquainted with key basic aspects of the physical layout and agriculture of the system. Since much subsequent work requires informants, it should be used to tentatively but systematically identify informants. Multiple intake systems must be disaggregated into hydrologically and operationally independent units before subsequent activities can be carried out, so this should be done as far as possible in the inventory. During the inventory the TO should introduce turnover to village and WUA authorities. The subsection chief should introduce turnover at the district (camat) level, perhaps in the monthly meetings with village representatives (rapat minggon). Brief information on who operates and maintains the intake (PRIS staff or farmers), is also useful to give sections data on which systems will require more thorough institutional development. Further information on O&M will be left to the profile, so as to avoid duplication and because the TO will be better trained to do that kind of interviewing at that time.

The following are suggested as the most productive activities in the inventory:

- Prior to any field work the turnover officer should introduce the turnover program to local authorities. The turnover officer should be given specific material about what to say to village and WUA authorities so as to avoid previous misunderstandings about the intent, scope, and local benefits and obligations of turnover. The subsection (ranting dinas) head and turnover officer should attend the monthly meeting at the district (kecamatan) office to introduce the turnover program to all in attendance, especially village heads and village agricultural officers (Kaur Ekbang).

- Identify temporary informant. As a method of introducing the turnover program to necessary additional local officials, and as a more systematic way of identifying initial informants to act as farmer representatives, the turnover officer should seek names of suggested farmer representatives from at least three sources. Then he selects one or two references which have been suggested by at least two of the original sources contacted (triangulation method). The three sources in general should be the village agricultural officer, the WUA head or representative, and the agriculture extension agent (who tends to be acquainted with valid farmer representatives), unless local knowledge suggests otherwise.

- Physical layout and condition. The turnover officer walks through the system with the informant and notes the physical condition of all structures. (This is already supposed to be done.) He should also records comments by the informant on what structural problems constrain management or agriculture.

- Sketch of system network delineating crop patterns. A simple sketch map is made of the system which delineates the main crop patterns and intensity in different blocks of the system.

- For multiple intake systems, identify single management units. If the system has multiple intakes, the turnover officer delineates the different management units, as identified hydrologically on the sketch map and in terms of there being any intensive management interactions between intakes. Clear criteria for defining single management units need to be identified and incorporated into the inventory if they aren't already. Such criteria might be existence of seasonal O&M coordination and control, whether or not a hydraulic link is a natural river or a main canal, etc. Numerous small systems sharing a common rivercourse may be considered by local PRIS officials as parts of a larger system, hence not eligible for turnover (such as is being considered in Lombok) unless criteria are clarified.

- How the intake is operated and maintained and by whom it is done.

5) The inventory should not be used to distinguish which systems receive SM assistance

Determining whether or not a system needs SM funds for physical repair or improvement must be done in dialogue with the users not only because they need to develop a sense of ownership and responsibility for the system, but because they have experience-based knowledge about what the system may or may not need. The inventory does not allow for this kind of dialogue, nor for ascertaining the willingness of farmers to invest. The profile should be used for determining whether or not a system should receive SM assistance. Either the inventory information will be highly tentative about this or else the impression will be conveyed that SM assistance is already determined from the start, and hence is being pushed by the government. This impression can be partially avoided or minimized by the recommendations for the profile, listed below.

It is possible for systems to have both high water availability and high cropping intensity but to also have very high maintenance requirements which may be becoming less sustainable due in part to changes in landholding sizes and off-farm income opportunities. System improvements such as lining and flushing gates may help lessen high maintenance requirements. Such matters are best left to the profile stage and the group meeting recommended below.

6) Inventorying incrementally or all at once?

There are advantages of conducting the inventorying of all small systems all at once at the outset of turnover implementation for a given PRIS subsection and if possible, for the whole section (cabang dinas). These advantages are:

a) to enable tentative prioritization of SM assistance based on broad comparison of apparent need,
b) to facilitate forward scheduling of systems for turnover based on locally important criteria (such as distance, staff placements, capabilities of inspectors to be turnover officers, etc.),
c) to make available to section or province turnover teams early field-level information to assist making early planning and preparation for turnover dissemination, and
d) to allow more lead time between inventorying and profiling to identify staff weaknesses in time to plan staff changes or training needs.

7) Using the irrigation inspector (juru pengairan) for inventory

The turnover program has great potential for reorienting the way the inspectors relate to the water users. Also they live relatively close to the turnover systems and have some knowledge of the local situation. Travel costs would be restrictive for staff used from farther away, such as section staff. Often those doing the inventory are not the inspector or are not the same as the turnover officer who does the profile. In West Java 11 of the 23 TOs did not do the inventory. (See Table 7-5) The irrigation inspectors should be used to perform the inventories since this provides an essential learning experience and will help supervisors determine whether or not the inspector can function as a turnover officer. It is important to have continuity (in part to avoid duplication) between the inventory and profile.

8) Training for inventory

Turnover officers often are unaccustomed to speaking publicly and explaining the turnover program to officials. They frequently use haphazard ways of identifying informants, such as relying on village government officials only or meeting farmers at random in the field. Several TOs expressed having feelings of inadequacy or lack of experience in making sketch maps. The training needs to put more emphasis on providing clearly detailed guidelines for what should be said to what officials, how to pose questions for interviewing, and a systematic method for identifying initial informants (such as suggested above). Technical skills in making sketch maps and describing physical condition of structures needs to be provided. Also trainees will need to be instructed in a standard method for calculating cropping intensity, based on the crop pattern sketch map which is suggested as one of the components of the inventory.

6.2 The Profile

1) Which systems should be profiled?

A determination of which systems should receive SM assistance should not be made prior to the profile where needs for improvements and willingness of farmers to invest in them are demonstrated. All PRIS small-scale systems may be eligible for SM if a need is demonstrated. Furthermore, the determination of which systems need what WUA development activities would be made in the profile stage. Hence, all systems should be profiled. This will be facilitated if the inventory and profile stages are streamlined, as suggested.

2) Streamlined focus on preparing for O&M transition

The profile should be restricted primarily to collecting information which leads to a decision or immediate action related to preparing for O&M transition. The emphasis should be on joint planning of preparation for management of the system by the users, not structural repairs per se nor formal establishment of the WUA. The profile following four components would constitute the essential and sufficient parts of the profile:

-- WUA investment and O&M tasks worksheet. This consists of four parts:

a) a record of farmer and government investment in the systems since at least Pelita I (1969/70),
b) a description of all O&M tasks in the system that have been done within the last five years,
c) a record of how the activities were carried out (by whom, what frequency, how organized, what fees and sanctions, etc.) over the last two years, and
d) an organization chart for the local WUA or other institution, if one exists.

-- WUA management performance and constraints diagnosis. This is a record of what current irrigation-related problems are constraining agricultural productivity (as indicated by variable cropping patterns, intensity, and yields) or the manageability of the system by the farmers.

-- WUA management preparedness needs assessment and action proposal. The two above activities are linked together in this assessment to demonstrate what improvements are needed to prepare the users for O&M turnover.

A general meeting should be held with the WUA to discuss the following items:

a) Turnover objectives and method,
b) Current management constraints and needs assessment,
c) Selection of system and block representatives as informants to work with the turnover officer,
d) Steps in the turnover process when WUA involvement will be needed,
e) Reactions of farmers to management preparedness action proposal,
f) Statement of willingness of the WUA, or farmer representatives, to participate in specified turnover activities (such as system walk-throughs, designing proposals, preparing O&M workplan) and
g) Attestation of willingness of farmers to invest in the form of unpaid labor in construction, in the event that construction assistance should become available. The subsection head should attend this meeting and do much of the speaking.

Preliminary proposals for system repairs and improvements should not be collected during the profile for four reasons:

a) To avoid duplication with the design stage; there is no need to collect proposals twice, this makes the farmers restless,
b) Valid farmer informants, competent to speak for the farmers as a whole about repair proposals, will only be confidently designated by the general WUA membership in the above-proposed general meeting at the end of the profile,
c) This will help ensure that the profile gives adequate attention to O&M and WUA preparedness, commensurate with the main long-term objective of turnover (to prepare for local O&M sustainability), and
d) This will help ensure that subsequent design and construction activities are justified by demonstration (in the profile) of a management constraint (rather than as an end in themselves).

3) <u>WUA development</u>

With this emphasis on functional O&M management needs and WUA development in the profile, it would make sense to move forward the training for WUA development from the design and construction stage to combine it with the profile training. The profile, as suggested, would provide the basis for immediate planning and conducting of WUA development activities. Not only would TOs have better understanding and skills to do the profile, with a longer-term objective of WUA preparation in mind, but they would also be ready to quickly pursue WUA development activities immediately during and after the profile is completed, rather than having to wait until the design and construction stage.

4) <u>Criteria for scheduling or prioritizing systems for turnover</u>

The section-level scheduling of which systems should be turned over in which budget years will include criteria related to: a) the predicted mix among systems of SM costs and institutional development needs, b) a sense of priority of need for turnover assistance, and possibly c) the relative degree of staff dislocation caused by turning over certain systems sooner versus later.

Information on the following criteria would be obtained in the profile, as mentioned above. These criteria should then be used to guide scheduling and prioritizing systems for turnover.

- How productive is the system already? (If the system has a high cropping intensity and relatively favorable yields, this suggests that the system may not need much preparation for turnover, partly depending on other criteria considered.)

- How extensive is the investment of PU in the system and has this created a dependency of the users on the agency? (Higher government investment, including present O&M management roles by PRIS, presumeably would require more preparation for turnover to the P3A.)

- How high a level of management intensity is required to manage the system productively? (Systems with high sediment loads, high discharge fluctuation, frequent flooding or water shortage, and variable cropping patterns and planting dates require more management than otherwise.) In the WUA meeting suggested above, farmers could be invited to compare the local level of management required to avoid deterioration with their level of willingness to invest.

- Is the level of organization and activity of the water users commensurate with the required management intensity, which is determined largely by physical and agricultural factors? Some systems need much less P3A activity than others. It is important to understand this before labelling a P3A "inactive". Also if the users are presently investing very high amounts of labor or materials in the system, this may not be sustainable in the future and may be an indication that some technical or physical improvement in structures is needed.

5) <u>Information conveyed to farmers on SM levels</u>

Staff doing the inventory need to more fully understand the purpose and process for turnover and be careful not to raise false farmer expectations about levels of SM funds to be allocated or create a construction, assistance-focused, or speculative attitude in the farmers. Farmers should not be told average levels of SM funds to be made available per hectare before the field-level budget is prepared. Otherwise the amount reported to the farmers may be a section-level average and may not apply to a given system. It may also include office-level overhead not understood by farmers.

6) <u>Accounting for information sources</u>

Also, preferred information sources used by the turnover officer in the inventory and profile stages need to be clarified and sources used need to be recorded (such as upper, middle, and lower-end farmers, officials from certain villages). Otherwise it is difficult to check the accuracy of the data at a later time.

7) Conglomerate systems which exceed 500 hectare

At some point within the time period for turnover of all systems below 500 hectare in size, a policy decision will need to be made regarding what to do about multiple-intake systems who's official areas exceed 500 hectare, but which in fact are administrative conglomerates of often in reality groups of multiple, independent systems. Such systems should also be inventoried, perhaps during "Time Slice" II (1990-93) to identify single management units which are below 500 hectare in size and should also be eligible for turnover. The longer the wait before this is done, the more PRIS will assume such systems are outside the purview of turnover. One example in the Kuningan Section of West Java is a "system" registered in the PRIS buku pintar as having an irrigable area of 935 hectare. However in reality it has 11 weirs, 50 free intakes, and involves three rivercourses.

8) Training for profile

In accordance with the above suggestions training should be adjusted as follows:

- Some, if not all, training on water users association formation and development should be provided TOs during the profile training, so that they will have a longer-term perspective on the usefulness of the profile and so they can continue field work on WUA development between the profile and design and construction stages. This would help prevent the occurrence of "dead time" in the field when WUA development activities could and need to be happening as soon as possible.

- TOs need more detailed material on exactly what should be asked or explained in each type of field setting, whether it be in an introductory interview with the village head, a WUA meeting, interviews with farmer informants, and so on.

- TOs need more practice with role playing each of the above types of situations in small groups in sessions and in the field.

6.3 Designing System Improvements for Farmer Management

1) Purpose and Limitations of Design and Construction

Different views have been expressed about what the proper role of design and construction is in the turnover program. One view is that the main purpose of making physical improvements prior to turnover is so that the system will be in good, operable, and permanent condition at turnover (in accordance with all farmer proposals for repairs) so that the level of management required will be lessened. This view argues for substantially raising the level of SM construction funds for turnover above the current Rp. 120,000 per hectare level. Another view is that the purpose of SM improvements should be to make minor repairs with farmer participation in a way which will stimulate the WUA to take responsibility for O&M in the future. This view implies that the per hectare rates probably should not be increased substantially above the current level. Although experience from the field should help answer this question, there are a number of reasons which support the latter view:

a) As we look at the record of long-term sustainability of irrigation works, it is largely a misnomor that concrete structures are called "permanent". The source of long-term sustainability of irrigation systems traditionally has been the local capability to perform routine maintenance and periodic repair, especially in unstable, hilly environments with rocky, high fluctuating river flows--typical of conditions where small systems are located.

b) Construction of numerous concrete structures, adjustable gates, and other modern structures are likely to break down and be too expensive for farmers to repair. It is likely to increase, not decrease the maintenance burden on farmers.

c) Under turnover the SM assistance should be used as a symbol of what the relationship between WUAs and PRIS will be after turnover, where there is joint investment, where both sides must economize, and where the agency assists farmers only in problems which are beyond their capabilities of resolving by themselves. Where the size of SM assistance effectively pays for all farmer proposals, or dwarfs in importance whatever level of equity the farmers provide, local dependency on the agency is reinforced.

d) If a high level of funds are made available the farmers will be inclined to ask for as much as possible. When asked to make a wish list of all physical improvements needed, they will tend to make long lists, with many items which are cosmetic or constitute deferred maintenance, as has been seen in several cases so far. This does not create a healthy WUA perspective prior to turnover.

e) Higher levels of SM funds per hectare will exacerbate the inequity between turnover systems and neighboring village systems, as well as larger agency systems, who may receive only the irrigation service fee. (However some ISF areas will receive SM assistance.)

f) Higher levels of SM funds are likely to cause more complex and sophisticated structures to be built, which may not be suitable for farmer management.

g) In most systems currently being prepared for turnover, cropping intensities are generally over 200% and often close to 300%. Farmers are already doing most of the O&M management. This does not suggest that heavy repairs are generally needed in the small systems.

h) Similarity between farmer and technical design versions implies that funds for the design component are probably already adequate.

2) <u>Openness or speculative orientation of farmers</u>

As has been seen in the stage one and two systems being assisted under turnover, farmers tend to make long lists of requests for repairs when they are not told how much the SM budget is for their system nor that any farmer investment will be required. They readily shorten the list and reprioritize when they are told the amount available or how many repairs can be made. The only way to avoid causing farmers to be speculative is to be open about how much will be made available to the system, as soon as possible. Turnover officers should be careful, however not to mention average per hectare rates that may not pertain to particular systems.

3) Duplication with profile stage

In Stage I and II areas tentative proposals for system improvements were collected during the profile stage and again later during the design stage. Often TOs merely redrew or refined the design pictures made earlier. Farmer proposals should not be collected or drawn during the profile but should be done once, during the design stage. This will avoid duplication and help ensure that the profile will be focused more on O&M management needs.

4) Collecting farmer proposals for SM construction

Turnover officers need to make formal committments with the WUAs for representatives to assist him in walking through the system and identifying farmer proposals for SM repair, in order to avoid haphazard use to different informants often with inconsistent views, as has hampered the process observed to date. Careful measurements and sketches need to be made on site with farmer representatives/informants who can interpret drawings made by the turnover officer.

5) Aspects of traditional design

The most important technical design criteria should be those related to farmer manageability after turnover. Simple or traditional structures used by farmers should be designed and constructed where appropriate, including flood diversion walls over intake channels, proportional water dividers, pipe or tube outlets, and so on. In hilly areas typical of the environments of small systems, water conveyance tends to be more a concern of farmers than aquisition (the intake), since the fast flowing streams can be easily diverted with temporary structures. PRIS should be responsive to these priorities, even if they may be different than the priorities of PRIS, which tends to emphasize diversion weirs and distribution (which tends to be more important in lowland areas).

6) Ranking proposals

Ideally, a several WUA representatives (from different blocks in the system) should walk through system to review locations of all proposals, just prior to a meeting to rank the proposals. Proposals obtained from system walk-throughs should be prioritized by the general membership of the WUA, not just informants. This should be done in the local village or system itself.

7) Setting for integration of farmer and technical design versions

Under the current arrangement the so-called farmer design version is actually made by the turnover officer and has not always reflected the intent of the farmers. Furthermore the meeting to integrate the two versions has sometimes been held far from the field, such as in the office of the district head, where the few farmers attended are reluctant to express themselves openly. The meeting to finalize the design should be done in the field, without high-ranking public officials present. However the subsection head should attend.

8) Prior WUA committment for participation in design process

Many of the difficulties encountered by TOs in identifying valid farmer representatives, getting them to go to the field as needed, and participate in design review probably could be overcome by holding a meeting for all farmers early in the turnover process, prefereably during the profile stage, as suggested in Section Three. In this meeting farmers would be informed about all aspects of the turnover process (especially each kind of activity where farmer involvement is needed), representatives would be selected by the general body of farmers, and committments would be made for farmers to attend meetings and make system walk-throughs with the TOs and contractors.

9) Supervision and guidance of turnover officers

Given the wide variation in practices used in the field during the design stage, it is recommended that improved supervision of TOs is needed, both in the form of at least bi-weekly meetings (during the design stage) with the coordinator as well as the use of regular assignment sheets and reporting of TO activities to the coordinator. The subsection head needs to be given an official role in turnover to help supervise TOs. He should attend general WUA meetings, such as when priority rankings are made and help the TO with public speaking. He should also be used to assist TOs in preparation of design drawings and budget estimates.

10) Elements of TORS if using consultants or guidelines if done by direct forced account

Official guidelines either for contractual or direct-managed (swakelola) design and construction are necessary to ensure proper farmer participation and investment in the process, so as to encourage, not discourage, the development of WUAs which will be responsible for sustaining O&M locally. Such terms or guidelines should include the following points.

a) Design consultants or construction contractors, where used, should be required to consult with PRIS section officers on system-level activities at least twice a month during their contracts.

b) After a dialogue and agreement between PRIS and the users about which parts of the system will be improved, design consultants or section staff should use the approved farmer version of the design as the basis for preparing the technical version.

c) Consultants, contractors or PRIS staff doing the technical design and managing construction should hold meetings with the WUA before, in the middle, and at the end of these activities.

d) The WUA should be permitted to have the role of a co-supervising party in the construction, being allowed to inspect such things as the planned and actual amounts of sand versus cement used, for example.

e) System water users should be the sole source of "unskilled" labor in construction and whenever possible should be used as skilled laborers as well.

f) Neither contractors nor design consultants, if used, should be paid in full before construction is completed satisfactorily and the PRIS section and P3A heads sign an agreement to that effect.

g) If at all possible, the consultant and contractor should be the same company and should be one from the local regency (kabupaten).

h) Contracts should be estimated on a volumetric basis with the provision that farmer requests for alterations in the field should be honored as long as the overall cost does not rise. This may be done if the PRIS section is able to reallocate additional resources or if the farmers can mobilize the resources to pay for any additional costs caused by alterations.

i) Contractors should be accountable to on-site technical supervisors from PRIS staff assigned to construction supervision.

11) Designing by direct agency force account (swakelola)

Most PRIS sections have staff with the technical skills to make the kinds of simple designs typical for the turnover program. It is preferable for the PRIS section to do the designs wherever feasible because of the increased likelihood of the technical design being responsive to farmer aspirations and management capabilities and because of the valuable experience this would provide PRIS in reorienting its approach to small scale irrigation in the future. The administrative burdens of doing the designs directly are much less than they are for construction. Efforts should be made to direct provinces to permit sections to do the designs where qualified staff are available and to simplify the administrative requirements of force accounts, where this can be done using national-level budget (APBN) funds from SM.

12) Need for a design guidebook for the turnover program

There is a need for a design guidebook for the turnover program because of the special and unconventional needs in designing improvements for farmer management. Such a guidebook could cover the terms for design constracts, steps in the design process, certain criteria related to cost and materials, and examples of simple types of structures which are appropriate for farmer management and relatively inexpensive to maintain. This would help facilitate administrative/contractual preparations for design and construction (including helping cut the time required), improve supervision, and help ensure that structures are not oversized or overly difficult for farmers to operate and maintain.

13) Training for design stage: drawing structures and estimating budgets

Two key skills for the turnover officer are important in the design stage and need more emphasis in the training: 1) how to draw pictures of the farmer proposals and 2) how to estimate the budget costs of proposed structures. Also additional detailed guidelines for how to obtain farmer proposals, interview farmers about proposals, conducting the meeting to rank proposals, necessary steps to take in the design integration meeting and further developing the WUAs, need to be disseminated and discussed. It would be useful for TOs to have more experience role playing conducting interviews and meetings. A field exercise making sample design drawings and budget estimates would be valuable. Wherever possible design consultants (and construction contractors, if already designated) should be invited to attend the design and construction training so that they will understand the new operating procedures based on farmer participation, flexibility and close cooperation with PRIS staff.

6.4 The Construction Stage

1) PRIS capabilities and preferences for contractual versus direct account (swakelola) methods

Since the work requirements and conditions are different in any two systems it is not possible to directly compare these two methods of construction in terms of length of time required. However it is the opinion of PRIS staff asked that there is not much difference between the two in time required for field implementation. The main difference is in the time for the tender process under the contractual method. The direct account approach requires significantly more staff time and considerable paper work, and needs to be simplified and streamlined if this approach is to be used very widely.

2) Implications of contractual versus direct account construction arrangements on farmer participation, flexibility and satisfaction

Originally, it was thought that direct account construction would be necessary in order to be responsive to farmers' aspirations. From the early experience to date with both approaches in West Java, considerable responsiveness and flexibility with regard to the farmers has been shown under contractual construction however. This has been where PRIS has had daily on-site supervision, quick transfer of information on field problems to the turnover coordinator at the section level, quick response from the section level, and willingness to be flexible within volumetric budget limitations. The key ingredients are field supervision and flexibility. Forcing the use of the direct account approach beyond section staff time capabilities can have a detrimental effect on relations with farmers in practice. Another option would be to pilot test having PRIS constract with the WUA, as a legal corporate entity, to carry out construction under the technical supervision of PRIS staff. This could be done by direct contract or via force accounts. It would have the advantage of developing local capabilities to plan and implement system improvements through the formal WUA. Also it would help establish local precedences for acknowledging WUAs as legal bodies with the ability to enter into contracts. Efforts should be made to simplify force account administrative and reporting procedures required under use of APBN special maintenance funds.

3) System-level budgets

Actual construction budgets should be based on total itemized cost estimates of proposals agreed to be constructed, rather than per ha averages. This would avoid residual funds and the need to revise rankings. The field-level component of such budgets should be shown to farmers as soon as available so as to encourage an attitude of trust and openness and to enable farmers to then plan their own investments. This will also help instruct farmers in how to estimate and plan system improvements. When using contracts, they should be on a total volume, not actual item, basis, so as to enable some flexibility and adjustments in the field during construction. This is necessary because there is a tendency for some design features to not become apparent to farmers until construction. This flexibility is possible as shown by several cases in Sumedang of adjustments made in the construction stage, where daily supervision and quick responses were made by the section office. To help ensure that contractors remain receptive to PRIS and farmer supervision, disbursements in advance of completion should not exceed roughly 25 percent of total cost.

3) Construction preparation meeting with farmers

Negative experiences have occurred where the general body of farmers was not informed about the construction work and pay arrangements in advance of construction. A meeting should be held prior to construction with the contractuor, PRIS, and WUA to plan with farmers the work schedule, which tasks will be done by which parties and pay arrangements.

4) Nature of farmer involvement in construction

PRIS should firmly require contractors to use farmer labor for unskilled labor. However contractors should be free to obtain skilled labor from their own sources where local capabilities are indequate. Farmers should be used on subcontracts to obtain sand, stone, or other materials and be given as much lead time as possible to plan collection of materials, and so on. Evidence to date indicates that farmers as a rule fulfill their pledges on time, unless the full WUA membership was not informed of pledges.

5) Construction payments to the WUA

Care should be taken to avoid more cases where the heads of WUAs withheld portions of bulk rate payments to farmer laborer for the collection of materials. This was done with good intentions but without making agreements with the farmers beforehand. Such matters should be discussed and resolved by the general WUA membership in the construction preparation meeting.

6) Farmer investment in construction

Some farmer investment in system repairs should be required for the following reasons:

- -- It fosters the farmers' sense of ownership and long-term responsibility for the system.
- -- It strengthens corporate identity of the WUA.
- -- It helps PRIS to allocate funds between systems, using local levels of willingness to invest as indicators of local importance of the repairs.
- -- It will decrease the amount of speculativeness among farmers and help limit the number of proposals to serious ones.
- -- It will reduce the funds required per hectare to some extent, allowing more systems to be assisted.
- -- It avoids the dilemma of PRIS helping systems where farmers have not actively maintained their system and not helping those where farmers have been more active. If levels of SM assistance are related to levels of local willingness to invest, then WUA activity is rewarded.
- -- It provides an example of joint investment as a symbol to farmers of what the future relationship with PRIS should be like after turnover.
- -- Farmer pledges to invest labor or materials can be relied on where the total membership are involved in making committments and there is some flexibility for arranging timing.

There are two basic options for requiring local investment, either one would fulfill the need for farmer equity. One alternative is to not pay unskilled labor. Experience with the village subsidy and village development program and the Starter Project suggest that this is a viable option. As indicated in Table 5-1, the value of unskilled labor in Stage I systems under turnover was 16.5 percent of the total value or Rp. 25,705/ha (compared to the average Rp. 34,473/ha local investment under the Starter Project). If unskilled labor were not paid this would substantially simplify force account reporting procedures. A second alternative would be to require an equivalent or some percentage value investment for structures to be repaired by farmers other than those built by SM funds. A standard rate required for corresponding local investment (such as 33 percent) has the advantage of clarity. Farmers can know the proportion from the beginning and can plan seriously. This avoids the development of speculative, dependent and suspicious attitudes among farmers towards the agency.

7) <u>A mechanism for allocating SM funds partially based on local investment levels</u>

A mechanism needs to be established, either at the national of provincial levels, for allocating per ha amounts of SM funds to the turnover systems within a section, which is at least partially contingent upon levels of local investment committed by the WUA. This would help avoid the impression of inevitability or arbitrariness of assistance levels. If unskilled labor is unpaid, the amount of such labor offered by the WUA could be the basis for making a roughly proportional allocation of funds between systems in a section. If joint investment is obtained on the basis of some structures being built by the agency versus farmers, then allocation could in part be based on the relative amount of work and materials offered for the farmer-built structures (in comparison between systems). SM assistance levels could be somewhat proportionally related to levels of local investment offered within the constraint of the total amount available for a given year at the section level.

6.5 WUA Development and Transition of O&M

1) When to form the WUA

In principle, the WUA should be legally formed prior to the start of construction, or if possible, prior to or in the meeting to integrate the farmer and technical versions of the design. The WUA would then be in a stronger position to approve or propose revisions in the design and to help supervise, as well as carry out, the construction. Having a formalized WUA conduct these activities will help legitimize the WUA from the perspective of the farmers.

2) Official WUA constitutions (AD/ART)

The provinces have official standard formats for WUA constitutions, which tend to be quite lengthy, difficult for farmers to understand, and requiring standard activities, such as fee collection, which may not be universally necessary. WUA constitutions should be consistent with work plans, based on local management requirements. Inter-departmental coordination should be established between PRIS, agriculture, the regional planning board (Bappeda) and perhaps the governors office to endeavor to simplify the formats and allow flexibility in O&M functional requirements. Communication should be extended to all regency heads (bupati) in advance of turnover implementation so they will be prepared to approved revised formats.

A clause should be added to the documents acknowledging that WUAs are legal entities with the power to own system assets (in anticipation of the impending process for turning over ownership of system assets to the WUAs), let contracts, obtain credit, and enter into contracts with third parties.

3) When should WUA representatives versus total membership be involved?

It is important that the total WUA membership be involved in the recommended introductory meeting during the profile stage when turnover representatives are selected and willingness to invest in repairs are attested, during the ranking of proposals (and possible establishment of the WUA at this time), preferably at the integration of farmer and technical design versions, during the construction preparation meeting, and at a formal turnover ceremony. Representatives should be able to work with the turnover officer for other activities.

4) Joint turnover process planning and committments

Given the difficulty many turnover officers have had in arranging system walk-throughs and other activities with farmer representatives, it is adviseable for turnover officers to inform the WUA in a general meeting early in the process of all activities needed under turnover, to have the WUA publicly designate system and block representatives, and obtain firm committments and agreed schedules for subsequent activities.

5) WUA development activities done by turnover officers and others

The institutional development of WUAs should be pursued after the initial analysis of local O&M management needs suggested under the profile. Where no formal WUA exists, a meeting should be arranged, perhaps coinciding with the meeting to rank proposals for system improvements, where WUA leaders are selected for the designated O&M tasks and related functions. A proposed WUA constitution, based on the O&M needs assessment in the profile, should be discussed, revised, and approved in this meeting.

6) Necessary and unnecessary standard features of WUAs

Each WUA should have a O&M work plan, at least one leader or representative, and rules or sanctions related to the work plan. It should not be expected that all WUAs should have a standard set of leaders, a water service fee, and regular schedule of meetings. Wide magnitude in structural and functional form should be permitted, to reflect local diverse organizational traditions and management requirements. The tendency to evaluate the WUAs along structural or standard criteria should be avoided. What really matters is the carrying out of effective, sustainable O&M by the farmers, to meet their own system objectives.

Hence, preparedness criteria should be functional, based on local management requirements. Such criteria should not become the basis for postponing turnover where it is deemed that farmers are not ready, because this will only further debilitate the WUA preparedness and may become an excuse for delaying turnover in many locations. Even where WUAs appear to be unprepared to take over O&M the irrigation inspector or subsection head will still be available to guide and assist the WUAs. Care should be taken to avoid requiring standard routine meetings with the entire membership and routine fees. Given the variety in actual local management requirements, criteria for WUA preparedness should be based on a local work plan, not standard or structural requirements.

7) Need for a WUA O&M work plan

After construction the turnover officer should assist the WUA in drafting an O&M work plan. This relates local irrigation problems or needs to O&M tasks. It should designate what need to be done, how, at what frequency, by whom, and supported by what sanctions and what forms of resource mobilization. The plan should then be implemented and monitored by the turnover officer through at least one season following construction. The work plan becomes a guide for future evaluation of WUA effectiveness and WUA system-specific, functional O&M-focused extension activity by the irrigation inspector.

8) Weir operations

The turnover officer should provide repeated on-site training to the WUA officers who will take responsibility for operating and maintaining the weir.

After turnover the WUA should be fully responsible for operating and maintaining the weir under the supervision of the irrigation inspector, who should visit the weir frequently immediately after turnover and then at least weekly in the future.

9) Need for O&M transition period after construction

The systems should not be turned over immediately following construction. There should be at least one season as an O&M transition period wherein the O&M work plan is revised (due to changes caused by construction), PRIS are relocated, and the turnover officer gives final O&M training and monitors how well the WUA implements the work plan and collects a fee (if one has been instituted).

10) Should timing of turnover be contingent upon perceived technical and financial preparedness?

Difficulties encountered in implementing the work plan should be cause for more intensive guidance by the irrigation inspector, not cancellation of turning over the status of the system.

11) When should training for WUA development occur?

In order to avoid wasted time, to begin WUA formation and development earlier in the process, and to support a more O&M-oriented profile, we suggest that the training for WUA formation and development be moved forward to the profile stage.

12) Turnover schedule for the larger-size systems

Field time made available for the inventory and profile should be increased relative to the size and complexity of the systems. It should be perhaps doubled for systems close to 500 ha in size, especially if in Java. Time needed for preparing the farmer version of system improvement designs will be even more sensitive to system size and complexity due to the detailed nature of repair proposals and the need to collect and rank proposals both at the subsystem and system-levels.

6.6 The Implementing Agency: Provincial Irrigation Service

1) Turnover staff organization at province level

It is clear from experience in West Java and West Sumatra that there is a need to create a small team of staff assigned fulltime to turnover at the beginning of implementation of turnover in a province. The team should immediately begin collecting and analyzing data from the preliminary data survey, plan and prepare budgets, conduct introductory meetings, develop and present training modules, and make supervisory and monitoring field visits.

2) Turnover staff organization in the sections

Experience so far indicates that the turnover officer is often in need of more guidance and supervision in the field, is often reluctant or unsure of himself in meetings with village officials and farmers, and has some technical weakness that need backup support. The turnover officer coordinator at the section level has become overloaded with administrative work such as assembling reports of the inventory and profile data, supervising preparation of system-level budgets and contracts for SM assistance, coordinating WUA formation activities, and so on. Hence, he lacks time for frequent field supervision of turnover officers.

Also since the subsection head is the structural supervisor of the irrigation inspectors and since he as yet has no formal role in turnover, it is recommended that the subsection be given a more formal role in assisting the turnover coordinator. The following tasks are recommended for delegation to the subsection head:

-- provides regular field guidance and supervision of turnover officers,
-- introduces turnover program to district head and village officers,
-- attends village-level turnover meetings when possible and assists the turnover officer with public speaking, such as during the profile, formation of the WUA and ranking of proposals, integration of farmer and technical design versions, construction preparation, and formal turnover,
-- assists and supervises the turnover officers in preparing sketch maps, farmer (and possibly technical) design versions, and in estimating costs of proposed repairs.

3) <u>Capability of the irrigation inspector (juru pengairan) to be the institutional organizer (TP4)</u>

As a rule, the irrigation inspector should be recruited to be the turnover officer. Wherever the inspector is capable and the situation permits it, the local existing inspector should be recruited to be the turnover officer for systems in his area. The inspector would not necessarily be required to work full time on turnover alone and so a less than full time field allowance pay would be adequate. This approach takes advantage of the inspector's local knowledge and provides the learning experience the turnover provides to more PRIS staff, thus expanding the reorientation effect, as PRIS moves to a new way of dealing with small systems. However, subsection staff or others may make acceptable turnover officers where the local inspector is considered inappropriate. In determining whether an irrigation inspector is qualified to become a turnover officer, experience and articulateness need to be given precedence over consideration of education levels.

Monthly transport and operational funds need to be increased to cover actual costs and provide incentive to turnover officers to go to the field. In general, turnover officers seem willing to work hard and be in the field, but often feel discouraged due to the expense and sometimes difficulty of obtaining transportation. In general it can be said that Rp. 45,000 per month is not adequate. The problem is much worse in Central Java, where the amount is Rp. 45,000 per year. Rp. 60,000 per month ought to be a minimal standard for TOs with at least two systems.

However there may be tradeoffs between providing incentive for turnover officers to function well and such considerations as the relationships among staff (some of which do not receive honoraria) and the effect on staff motivation later when the transport funds are discontinued. Pay should be monthly rather than daily, as was attempted in West Sumatra, so that the turnover officer will be able to arrange his own schedule to go to the field as often as needed. Pay should be based relative to scope of work and distance travelled, including number of systems, area, and distance travelled, rather than giving all turnover officers the same amount.

4) <u>The role of the subsection head (kepala ranting dinas)</u>

The subsection head should be given an official role in turnover, mainly to assist with supervising the turnover officers and helping them in areas in which they are weak, such as technical aspects of design and public speaking before WUA meetings. TO coordinators have not had time for this. Such tasks could include: 1) supervising the generation of system-level cost estimates of farmer proposals (the <u>RAB</u>), 2) advising turnover officers on preparation of farmer versions of the design, 3) construction supervision, 4) participating in the design integration/review meetings 5) attending and helping speak at WUA formation meetings, and 6) give guidance to the TO in O&M training. Additional SM funds should be allocated to provide monthly travel and operating funds for the subsection head.

5) <u>Workloads and the tendency to limit and consolidate turnover staff</u>

The proposed limit on the number of systems a turnover officer should be working on to three is being exceeded in some cases and some turnover officers have to travel significant distances to their systems. The tendency to consolidate the number of turnover officers to more than three systems per officer should be avoided in the interests of allowing more inspectors to be involved and gain the training and experience needed, allowing adequate time for the intensive field activities, and using only staff which can be supervised by the subsection head, in his area.

6) <u>Allocation of funds for preparation of O&M management</u>

More funds should be allocated for management-related activities important to turnover, even if this means reallocating more funds out of the SM budgets. Such needs include: higher monthly operating/travel funds for turnover officers, who are frequently expected to provide refreshments to farmers in the field during walk-throughs and interviews and operating expenses for subsection heads.

7) <u>Structural orientation and orientation towards structures</u>

Training and supervision of turnover should emphasize the long-term anticipated effects of current turnover activities, such as preparing for joint O&M investment in the future and self-reliant WUAs, so that staff do not get too obsessed with immediate project targets. Using the existing institutional structure of inspectors and subsection heads, and dispensing with such project-based terms such as turnover water managers guidance officer (TP4), would help instill the feeling of functional continuity of the turnover orientation. Provinces should develop monitoring mechanisms and more detailed guidelines for institutional development activities to see that adequate attention is given to the management aspects of turnover preparation, in comparison with physical construction.

8) Inter-agency coordination

At the outset of turnover implementation in a province, meetings need to be held with the regional planning board (Bappeda), agriculture, and PRIS to introduce turnover to the other agencies, to coordinate and schedule WUA training activities for systems scheduled to be turned over, to attempt to simplify the WUA constitution forms and facilitate the process of WUA validation, and discuss reporting arrangements for formal turnover of O&M authority and eventual turnover of assets.

9) Relation of turnover to other aspects of efficient O&M under the irrigation subsector loans

Turnover should not be conducted in isolation from the irrigation service fee since the two programs have mutually reinforcing incentives. Farmers in small systems who are aware that water users in agency systems will be paying a service fee to the government will be more inclined to support turnover. Also turnover should be seen and implemented by PRIS as part of an overall transition to more efficient allocation of resources in O&M. Hence, needs-based budgeting would provide impetus and guidance for staff reallocation following turnover.

10) Alternatives for staff reallocation

The DGWRD and PRIS need to clarify the alternatives, criteria and mechanisms for dealing with PRIS staff after turnover. For example, it needs to be determined what will be done with daily labor status staff (harian lepas). Will they be automatically released, unless they are willing to move to work in systems over 500 ha in size? However, length of time working for PRIS may be a factor. In general, it may not be possible to release so-called harian tetap or contract laborers and civil servants certainly will not be released, so viable alternatives and criteria for relocating or reassigning different types of staff need to be clarified by the DGWRD and the PRIS.

11) Rivercourse management orientation

PRIS should take on a more active and systematic management role at the inter-system or rivercourse level. It should give more emphasis on coordinating water use between systems and assisting with incidental repairs only for problems which are beyond the WUA's capacity to cope with themselves. PRIS may need mobile special repair assistance teams. The irrigation inspector may need to be more mobile, perhaps requiring the use of a motorcycle.

Upon completion of turnover in a given section a rivercourse inventory should be conducted which would assemble basic data on all offtakes along rivers, in support of the PRIS's changes in its management roles. This kind of inventory should include information such as: the mapped location of each offtake (for PRIS and village systems), size of irrigated area, cropping patterns, usual planting dates for each season, identification of key WUA, village, or farmer leaders in each system, nature of rotations between systems, maintenance problems, and hydrologic interconnections between systems.

12) Toward an optimal mix of agency/farmer investment in irrigation

PRIS should take advantage of the turnover program to convince the WUAs that they will have to become self-reliant in routine O&M in the future. The SM assistance should be a form of joint agency/farmer investment in order to demonstrate to the water users that future PRIS assistance will only be given occasionally under the joint investment rule and that PRIS assistance will be used as a stimulus not a replacement to local investment.

13) Dissemination of Turnover Program

Four aspects of the current implementation of the turnover program need to be discussed and improved to increase the efficiency and effectiveness of dissemination. These are listed below.

a) Targets and basic principles - Some flexibility is needed in area target acheivement since the turnover program is new and has a number of aspects which are unconventional, for which PRIS staff have little or no prior experience, such as: identifying informants, the inventory and profile, the participatory process of design and construction, WUA development by PRIS subsection staff, preparation of O&M workplans, transfering staff out of systems, and so on. These essential aspects should not be sacrificed in the interest of acheiving targets, or else the long-term objective of sustainability will suffer. However as was seen in Section 1, the social or participatory components are not the primary aspects which have taken longer than expected.

b) Spread within and between provinces - The original rate of expansion of turnover between provinces was to be to 10 provinces by 1990. This was recently changed to seven provinces because of the judgement that this rate exceeded the national-level capability of DOI and LP3ES to provide guidance, training, and supervision. The original plans for turnover had the program disseminating at geometric rates both within and between provinces, reaching 17 provinces by 1990/91 and all 27 provinces by 1992/93. Due to both the great diversity of conditions and capacities between the provinces, the reliance of the provinces on considerable guidance and support from the national level, and the limited capacity for providing such support from the national level, we recommend that the rate of increase to new provinces be slowed to reach only 10 provinces by 1990/91, thereafter expanding at an additive rate of preferably no more than four new provinces per year. The last provinces in the process will have the fewest small systems and hence will not take long to complete the process. The rate of expansion between PRIS sections within provinces probably can be faster because of the potential for overlap in planning and training at the provincial level.

c) Concentration within sections - Instead of the current tendency to create maximum spread in turnover systems within sections, sections should be encouraged by the provinces to concentrate turnover within a few subsections at a time. This will simplify and improve supervision, cut travel costs related to supervision, cut costs for design and construction (especially for contracts), make it easier to reach agreements with contractors, facilitate better and more immediate evaluation of the effects of turnover in areas where it is concentrated and will enable better forward planning for staff reallocation and rivercourse management.

d) Is it a good idea to finish turning over all systems less than 150 ha before turning over systems up to 500 ha in size? - It is not very efficient to turn over all systems below 150 ha in size before turning over the larger category systems. This also creates inefficient high distances between systems during turnover, since many of the larger systems which would be skipped over, are in close proximity to the smaller systems and otherwise could be turned over simultaneously. Also it will mean that a time gap will occur, especially at the lowest levels, between turnover implementation for the smaller versus larger size systems. Training and other administrative and planning tasks may have to be repeated later when turnover begins for the larger size systems.

   It is advisable for <u>each section</u> in all provinces to select at least one pilot system between 150 ha and 500 ha for turnover at the beginning of the turnover process in each section. This will provide the information and experience, at the level it is most needed, to prepare for turnover of the larger size systems as soon as is feasible. In many areas, such as West Sumatra, conditions relevant to the turnover process are not dramatically different between systems above and below 150 ha. This will facilitate integrated and simultaneous turnover of the smaller and larger size system commensurate with local capacities.

14) <u>Making training of turnover officers more appropriate for irrigation inspectors</u> Training needs to be improved so as to better reflect the current background and perspective of the turnover officer trainees. Namely, more emphasis needs to be given to specific methods, instructions, and guides for how to implement various tasks under turnover which are new to the turnover officer's experience. Participatory and feedback techniques should be increased, such as more use of quizzes, questions and answers, role playing, and group problem solving. In contrast to what seems to be the case so far, training should not be based too much on the assumption that the trainee will have the authority, education, intellectual creativity or relatively democratic conditions in the field to act as an identifier and solver of problems and arbitrator between PRIS, villages and WUAs. Attention needs to be given to providing more short but specific and detailed guides as material for training. (See Sections 3 through 7 and Section 8.4 below)

15) Continuing monitoring, evaluation, and research is needed. In monitoring this includes construction problems, the O&M transition stage, post-turnover activities including PRIS staff reallocation, training enhancements and WUA development strategies. In evaluation this would include farmer response to construction, comparison of WUA O&M activities, system condition (eg. siltation and grass coverage) and system productivity (eg. cropping intensity) before and after turnover in selected systems. Useful research topics include the nature of water management in large-scale (ie. over 500 ha) systems managed by farmers and the documentation of aspects of traditional irrigation structural designs in farmer-managed systems. (Section 7)

4. ADMINISTRATIVE REPORTING

Financial Arrangements

The Phase II Technical Assistance on Efficient Irrigation Management and System Turnover (TA 937-INO) commenced on October 1, 1987. The total cost of the activity is $1,024,000. The project was initially planned for a period of 24 months until 30 September 1989. However, in the middle on 1989 a no-cost extension was requested in order to complete field testing of a number of activities. The is request was approved, and the project is due for completion on or before December 31, 1989.

The primary contributors have been the Asian Development Bank ($600,000) and the Ford Foundation ($300,000). The Government of Indonesia has contributed office space in both Jakarta and Bandung and paying the associated costs for office rent and maintenance to the value of $54,000. IIMI has provided support for administrative costs incurred in Sri Lanka ($70,000).

Financing from the Ford Foundation was made immediately available on 1 October 1987. The prompt disbursement of Ford Foundation funds was particularly helpful in that it enabled a direct follow-on from Phase I without any disruption of activities: field data collection programs continued, and there was no break in continuity of staff seconded to the Study by Public Works or employed directly by IIMI.

Funds from ADB could not be released until formal approval had been obtained from both the ADB itself and the Government of Indonesia. This process commenced during Phase I but for various reasons could not be completed until March 1988. However, access to these funds was backdated to 1 February 1988, being the date on which final Government of Indonesia approval for the project had been granted.

Office Facilities

The Department of Public Works has continued to provide office space for use by IIMI for implementation of the Phase II activities together with cost of upkeep and maintenance of these facilities. It has proved invaluable to have offices next to counterpart colleagues.

The office in the Directorate of Irrigation I, provided for the IIMI Team Leader and staff during Phase I, was made available for the duration of Phase II.

In October 1987 an additional office was made available to the Study in the Provincial Irrigation Service Building in Bandung to facilitate field activities in West Java. With increases in both IIMI staff and PU staff working on System Turnover, a second room was provided in March 1988.

Field Facilities

Phase II activities have been undertaken in three Provinces: West Java, Lampung, and West Sumatra.

For the Efficient Irrigation Management component field studies have been completed in West Java (Maneungteung and Ciwaringin Irrigation Systems) and Lampung (Way Jepara System). In each location the Study has provided accommodation for field workers. At Maneungteung IIMI has rented a mess for use as a site office and to accommodate visiting staff. In Way Jepara a small mess was made available to Study personnel by PU.

For the System Transfer component field studies are underway in West Java (Sumedang and Kuningan Sections) and West Sumatra (Solok Section). Accommodation is provided for PU staff seconded to Phase II, a mess provided in Solok and an office in Padang, both in West Sumatra.

Staffing

The same staffing pattern has been provided for Phase II as was developed during the first Study. Primary coordination is provided by the Head, O&M and the Head, Tertiary Development within the Directorate of Irrigation I; both of whom have part-time commitments to the Study. Full-time staffing has been as follows:

IIMI International Staff:

Dr. Sam Johnson III, Team Leader for Phase I, continued in this position until 19 December 1987 when he returned to the United States.

Dr. Hammond Murray-Rust, previously with IIMI in Pakistan, took over the position of Team Leader on 15 December 1987, allowing a brief overlap with Dr. Johnson for transfer of administrative responsibilities.

Dr. Douglas Vermillion was appointed as an IIMI staff member from 1 October 1987. Previously he had been a Post-Doctoral Fellow with IIMI on the Phase I activity.

Staff Seconded by Department of Public Works: As in Phase I, PU has continued to provide support to the Study by seconding staff for full-time assistance to project activities. During most of Phase II there were 17 members of PU staff seconded to project activities:

Senior Technical Advisor (Bandung)
Research Coordinator (West Java)
Research Coordinator (Lampung)
13 Field Observers: 3 in Maneungteung, 2 in Ciwaringin, 1 in Kuningan, 2 in Sumedang, 4 in Way Jepara, 1 in Solok,
Data Analyst (Jakarta)

For the pilot testing of activities for Management Information Upgrading six staff of the West Java Irrigation Service in Bandung, Cirebon, and Indramayu were seconded to IIMI for five months in order to provide the necessary field training and supervision.

Staff Hired by IIMI: To complement staff from PU, IIMI has hired 17 staff for field and office support:

Jakarta: Secretary
Driver
Office Assistant

Bandung: Social Scientist for Turnover Activities in West Java
Data Analyst
Secretary
2 Data Clerks
Office Assistant
2 Drivers

Ciledug: Water Management Specialist
2 Mess Staff

Padang: Social Scientist for Turnover Activities in West Sumatra
2 Research Assistants

In addition, IIMI has hired local residents for routine field data collection activities. At peak demand over 60 such people were employed part-time.

Allied Activities

To supplement activities being undertaken under the Terms of Reference for Phase II, the Study has been able to take advantage of a grant from the Rockefeller Foundation to develop a set of collaborative activities between IIMI and the International Rice Research Institute (IRRI). Under the terms of the agreement, IIMI is subcontracting research to the University of Gadjah Mada and has hired additional field staff for data collection and analysis. IRRI is working in collaboration with AARD, represented by the Sukamandi Research Institute for Food Crops (SURIF) and the Soil Research Institute (SRI) in Bogor. The project commenced on January 1, 1988 and is expected to continue until June 30, 1990.

The purpose of the project is to focus on constraints to increased production of non-rice crops in rice based cropping systems. IRRI, SURIF and SRI are investigating the constraints that result from soil physical changes resulting from tillage for flooded rice conditions on subsequent non-rice crops, farmer cultivation practices for non-rice crops, and tertiary level water management practices. IIMI, PU and UGM are investigating constraints arising from poor drainage, assessing the relationship between main system management activities and tertiary level water management, and the prospects for improved management of system operation.