Improving Dry-Season Irrigation Management in Indonesia: Findings, Issues, and Manageable Alternatives

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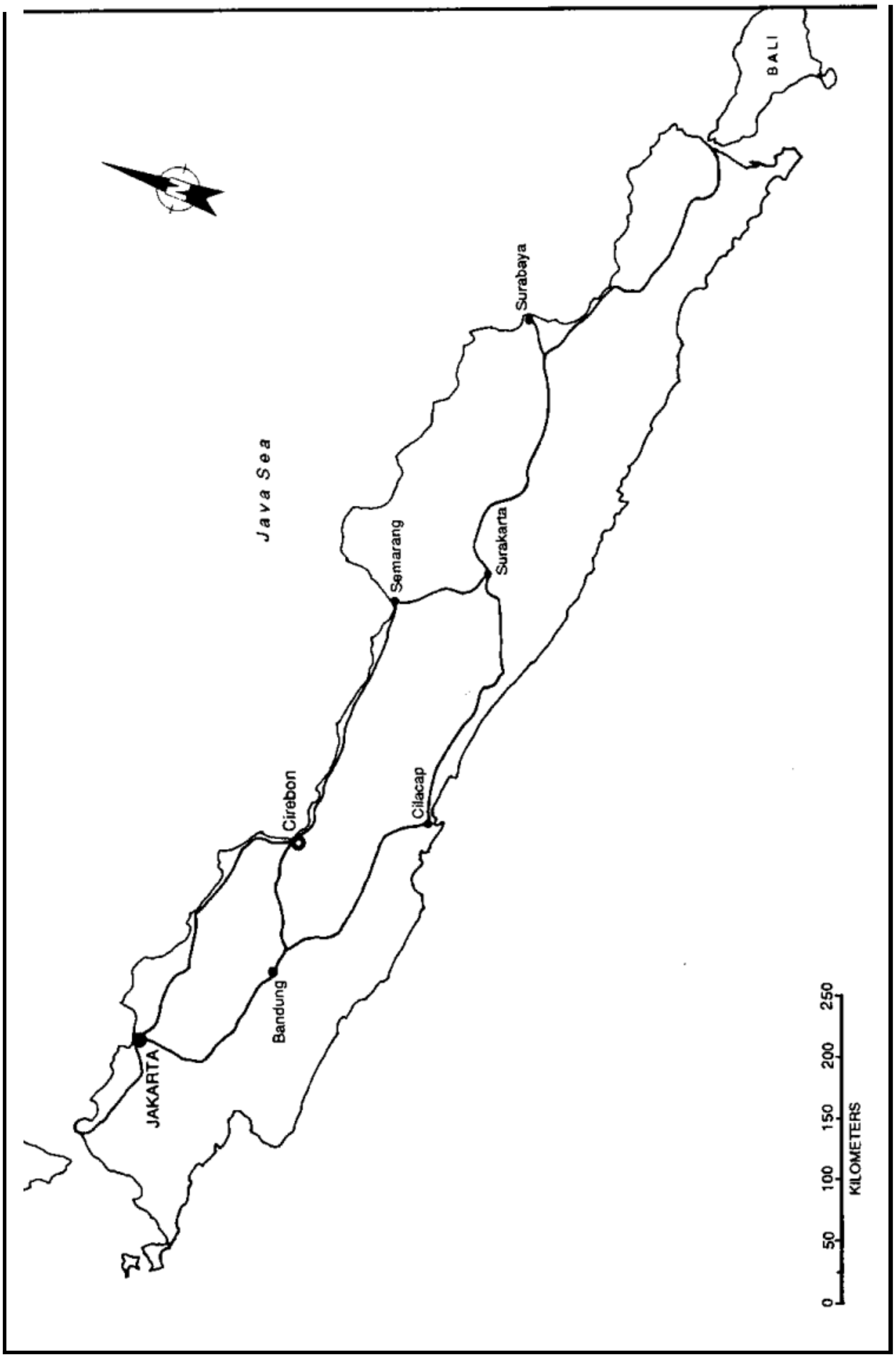
OVERVIEW OF THE STUDY

THIS STUDY WAS part of a two-year Phase II research and development program, funded mainly by the Asian Development Bank and the Ford Foundation. A grant from the Rockefeller Foundation enabled IIMI to conduct additional activities with particular emphasis on crop diversification and dry-season irrigation.

The observations made in this study were conducted in the 7,800 ha Cikeusik Irrigation System in the Cirebon Regency of West Java (Figure 1). It is a large-scale lowland irrigation system originally designed primarily for rice cultivation in rotation with sugarcane production. This traditional crop rotation has stimulated *palawija* (seasonal nonrice crop) production in the irrigable area of the system, including such crops as red onion, chili, green bean, mung bean, and groundnut — in rotation with rice and sugarcane.

This study has focused on two key aspects which have profound impacts on dry-season irrigation management performance: the annual crop plan process and rotational irrigation.

In Indonesia, *Rencan Tata Tanam Tahunan* (the annual crop plan) is an administrative arrangement for coordinating among local government, the agriculture and irrigation services, and offices responsible for local security. The purpose is to obtain a consensus about crop areas and planting schedules, as well as annual drying in the Provincial Irrigation Service (PRIS) systems. Such a consensus should satisfy national agricultural objectives as well as the aspirations of farmers who face local constraints, risks, and incentives. The annual plan requires coordination between government agencies at *kabupaten* (the regency) and *kecamatan* (district) levels, and village officials and water users' associations at the village level. The



Java Sea
BALI
Surabaya
Semarang
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Cirebon
Cilacap
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KILOMETERS

primary interest of local government and the agriculture service in the plan is the achieved crop targets, which are handed down from the province level and reflect national priorities. The primary concern of the provincial irrigation service is to propose crop areas which it expects to be able to irrigate, within anticipated water supply and distribution constraints. This study compared the official plan process with actual implementation in the field to determine management constraints and potential for improvement through the identification of alternative approaches, which are suggested for further field-testing.

The second component analyzed conventional rotational irrigation in the Maneungteung System and included pilot testing of the formation and implementation of a modified approach to rotational irrigation. The objectives were: a) to analyze current rotation practices, b) to develop and field-test an improved rotation system, and c) to identify improved rotational methods which might have broader relevance in Indonesia, especially in rice-based systems undergoing crop diversification.

THE RELEVANCE OF MANAGEABILITY

Since both crop plan and rotational irrigation contain important government policy objectives (in short, productive and equitable irrigated agriculture), it follows that it is in the interest of the government to see that these processes are, in fact, manageable ones.

This paper assumes a standard definition of management, which is, "the process of setting and achieving objectives through the acquisition and utilization of resources." Good management performance is the "efficient and effective acquisition and utilization of resources to achieve organization objectives." Seven standard elements are generally referred to as required ingredients in making human enterprises manageable (Figure **2).** These are:

1. Clear objectives. They should be specific and uniformly understood by staff, there should not be dual or conflicting official versus unofficial objectives, and objectives should be altered as the situation requires;

2. Implementation procedures. They should be practical and realistic to imple ment, given the resource and skill constraints;

3. Adequate resources. Staff, skills, technology, funds, materials, water, land and other inputs should be sufficient to accomplish the objectives at an acceptable level of efficiency;

4. Control. Managers should be able to ensure that the acquisition and use of resources leads to the achievement of objectives; it should be possible to attribute management activities and results to individual managers and staff and staff should not be held accountable for any outcome which goes beyond their control;

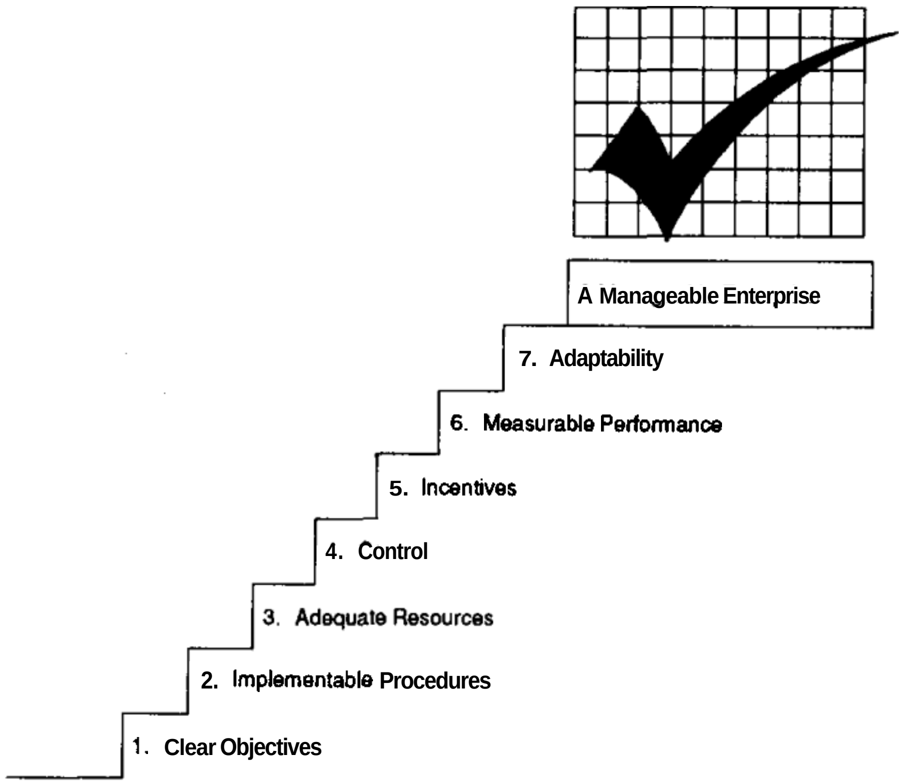
5. Incentives. There should be positive and negative inducements for managers and staff to be motivated to achieve the objectives of the organization;

6. Measurable performance. It should be possible to document and know what the outcomes of management are and whether or not the objectives were achieved; and

7. Adaptability. Organizations must be able to change any of the above six elements as changing conditions require it — either in order to continue to achieve objectives under new conditions, to achieve them more effectively or efficiently, or to achieve new objectives pertaining to new organizational purposes.

For prominent sources on these management ideas, see for example, Drucker (1979), Anthony (1988), and Israel (1989). For an example of application of management science to irrigation, see R. Chambers (1988).

Figure 2. **Sewn** *essential elements of a manageable enterprise.*



MAJOR FINDINGS

The Crop Plan

Objectives and procedures of the plan. The objective of the annual crop plan process is to plan and implement crop area configurations and planting times which are reasonably consistent with farmer preferences, with predicted irrigation supply constraints, and with government policy crop targets. In most areas of irrigated agriculture in Indonesia, rice is the standard crop for wet season. Hence, the more important and problematic part of the crop plan is that dealing with the dry season.

Each year the national and provincial level offices of *Departemen Pertanian* (the Agriculture Department) prepare annual targets for different crop types. While these targets are being disaggregated down to the level of regency imgation committees, the bottom-up process of assembling a Water Users' Association (P3A or WUA) planting proposals for the next year also should be underway. According to regulations, the WUAs should hold a meeting and decide on crop areas for the coming year, beginning from the dry season and running through the following rainy season. The fanner proposals are transmitted to the village agricultural officer. This officer assembles a report for each block or WUA in the village and reports the proposals to *juru pengairan* (the irrigation inspector) and the agricultural extension officer (PPI).

The inspector should collect the proposals for all WUAs in his area and report to the PRIS subsection head, at the district level. The subsection head revises the proposals based on considerations of demand/supply constraints, and passes on an aggregate proposal report to the PRIS subsection head, which specifies expected supply conditions per secondary canal per system.

A draft proposal is made at the district level and submitted to the regency irrigation committee, where the plan is discussed and approved by the *bupati* (regency head). At this level the plan is in the form of crop areas per district and village, not per tertiary block. The plan is sent to each district where village- and block-level targets are set. The village agricultural officers should be informed of the village- and block-level plan either in meetings at the district office or by communications from the irrigation inspector and agricultural extension agent.

Manageability of the crop plan process. From interviews and observations done by the Study Team at the section, subsection, and system levels of PRIS, and at the level of 12 sample tertiary blocks in the Cikeusik System, it is apparent that what is actually implemented is not always consistent with what is officially intended (for more detailed data of findings see Vermillion and Murray-Rust 1990). The objective of this study was not to find fault, but to determine to what extent the crop plan process is being implemented, what the management constraints are and what potential there might be for improving the process to achieve more productive dry-season imgated agriculture.

As observed, the annual crop plan does not appear to be able to adequately predict supply or demand, or to have a substantial impact on actual cropping practices in the field, except where special intensive extension efforts are made in pilot areas, usually by the agriculture service. It does not seem to be a plan with a mechanism for implementation since the real crop planting decision makers, the fanners, are generally not included in either proposing the plan or being informed about it. There are no sanctions applied against unpermitted planting practices. The tendency to annually report the same proposals which are largely influenced by the current year's crop or local multiple-year crop patterns, gives the process a reactive rather than a directive nature, and may perpetuate inequities in cropping intensity between upper- and lower-end blocks. The process seems to be an overly intensive administrative exercise which is being implemented at a much lower level of intensity.

The annual crop plan can be assessed relative to the principles of manageability as follows:

How clear and specific are the objectives?

The crop plan represents a set of specific and clear objectives to be implemented at the systems and at tertiary levels. However, it is not clear what the primary criteria should be for developing the plan, whether it should be mainly farmer or block-level aspirations of the farmers, government crop quotas, etc. One key problem in the current method which based the plan on the block-level expected crop types for the coming year is that it perpetuates inequity in cropping intensity by accepting the status quo both in lower-end and upper-end areas.

How implementable are the procedures?

This is one of the weakest aspects of manageability of the crop plan process, in that, the original plan announced by the bupati sets crop targets according to regency and district-level administrative units, not according to tertiary blocks. This must be disaggregated and realigned according to hydraulic units (which is often difficult to do). At the farm level, farmers or village-level officials generally do not find it possible to designate which fields can plant padi or which cannot, during the dry season. Crop plan configurations within and between the blocks are not based on considerations about difficulty of estimating irrigation requirements and delivering appropriate amounts to areas with diversified cropping patterns within and between blocks.

How measurable are the results?

It is not difficult to measure the results (i.e., actual crop areas) and this is a routine practice. The only problem here is the question of whether or not area estimates and block maps exist or are accurate.

How adequate are the resources?

Staff, transportation and other resources for the tasks of collecting crop and water data and holding the prescribed extension meetings appear to be adequate, except for the low staff-pay levels.

How controllable is it?

Control is the other weakest aspect of the manageability of the crop plan. Clearly farmers generally decide on which crops to plant for any given season. This is usually done without a knowledge of, or reference to, the crop plan. Another aspect of poor control is the weak and only indirect link between prescribed PRIS management tasks relative to the plan and the outcome which is expected. Collecting crop and water data and announcing a crop plan to farmer representatives constitute a long step removed from actually seeing which crops get planted and when.

How accountable are the staff?

PRIS staff (especially inspectors) are reasonably accountable to their supervisors for the data and extension work due to the prevalence of weekly or biweekly meetings. However the subsection chief must also visit the field frequently in order to independently evaluate reports of the inspectors.

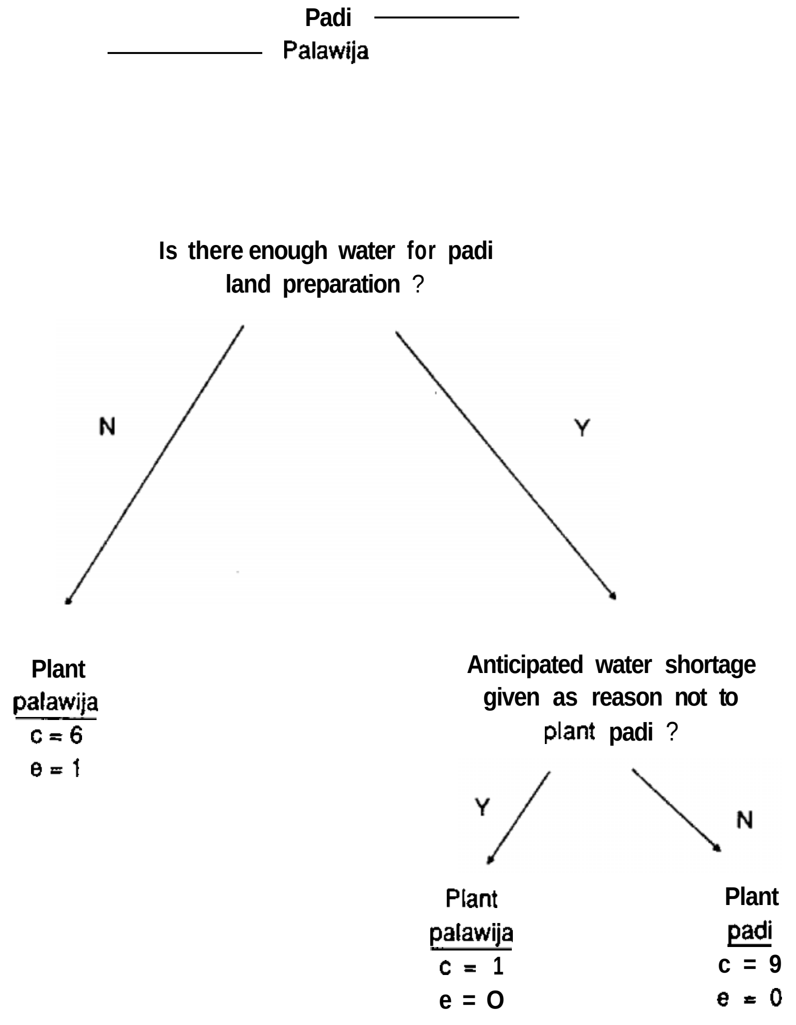
How supportive are staff incentives?

The low salary scales and outside income-earning of field operations staff weaken the incentive of inspectors to visit all the village agricultural officers for their input and to extend information to them about the plan. A low transport allowance to subsection chiefs may inhibit frequent field supervision. On the farmers' side, there is a wide number of local incentives which they consider in actually making a decision such as which crop to plant, perceived availability of water, drainability of soils, land tenure, threat of pest attack, perceived profitability, etc. However, farmer decision-making data suggest that the availability and drainability of irrigation water in the dry season are prominent factors in deciding whether to plant rice or nonrice crops (see Figures 3 and 4). This is usually considered and acted upon by farmers who are oblivious to the crop plan.

How manageable is the crop plan process?

The crop plan process is almost impossible to implement as planned, because of the difficulty of adapting administrative-based data to hydraulic units and the lack of agency control over crop decisions. Perhaps the crop "plan" should be reconsidered as a "guide," instead of a "plan," which implies a direct connection between staff action and desired result.

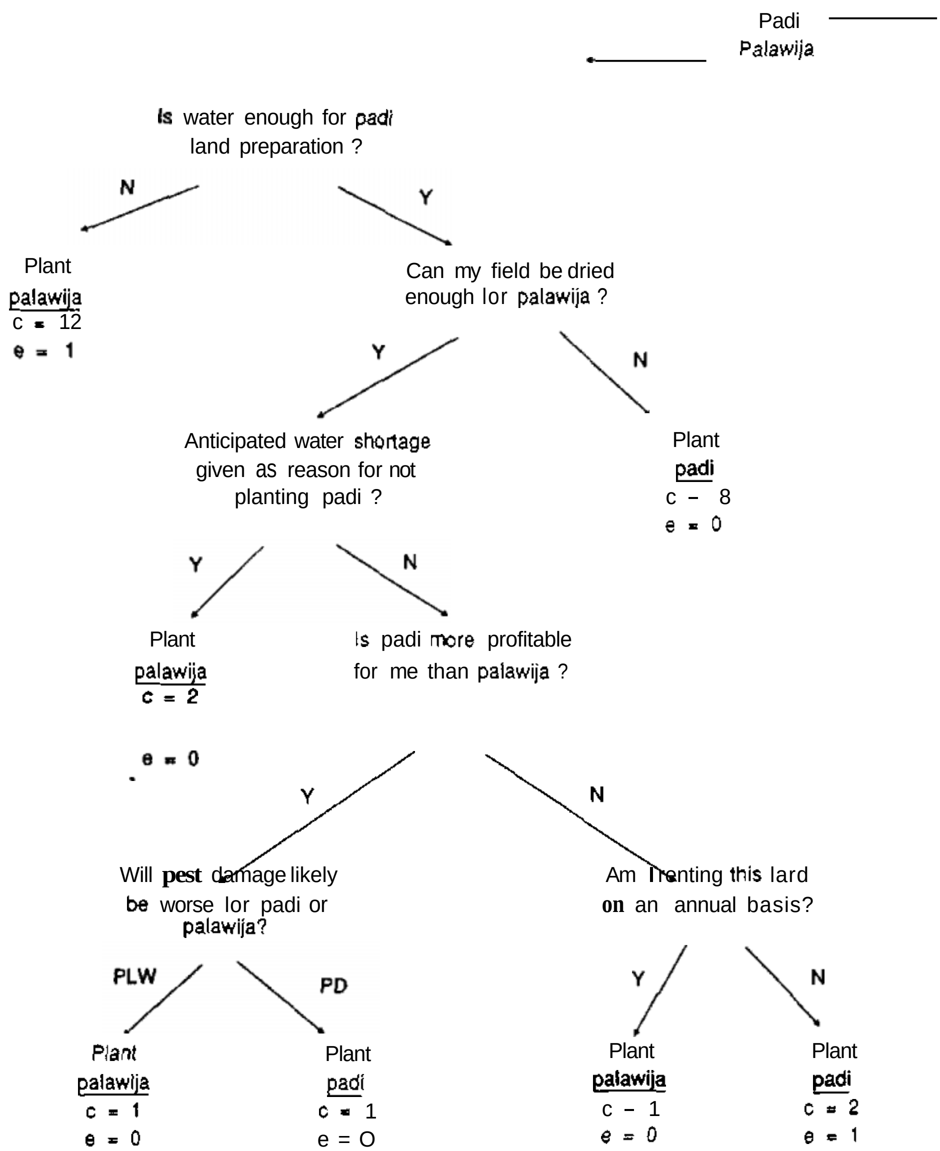
Figure 3. Farmer decision model to plant pndi or palawija, Jasem 7 Blo, West Java, for the first planting period of 1986 dry season (Gadu 1).



Correct responses: 15

Error responses: 1

Figure 4. Farmer decision model to plant padi or plawija, Jarot 2 Block, Central Java, for the first planting period of 1986 dry season (Gadu 1).



Correct responses: 27

Error responses: 2

Rotational Irrigation

Objectives ***and plan.*** There are three primary reasons why rotational irrigation is practiced 1) shortage of water to meet irrigation requirements, 2) conveyance difficulties when discharges are significantly below design capacity of canals, and **3)** the need to avoid overirrigating nonrice crops that are susceptible to yield reduction under conditions of excess water. This paper focuses on the first two reasons because they involve modifications to normal operating practices of rice-based irrigation systems. Rotations for agronomic reasons are usually conducted at farm or field levels and are therefore normally outside the operational jurisdiction of irrigation agencies.

The objectives of rotational irrigation are different from those of irrigation management when water is in sufficient supply to meet all or most of crop water requirements. During rotation, the basis for water allocation which pertains under continuous flow, is no longer valid and a new set of rules is applied. The altematives most often considered by system managers are:

1. Allocation based on proportionality of crop demand, i.e., where water is allocated in proportion to actual field-level demand, so that rotation unit sizes and locations are arranged to have similar water demands per standard unit of time, and will receive a fixed percentage of total available water; or

2. Allocation based on equity of proportional areas, where water is allocated in proportion to the total irrigable area (regardless of crop type), so that each farmer has equal access to scarce water supplies.

If the first alternative is adopted it is unlikely that the system will meet equity objectives because water is allocated in response to the proportion of area that has already been planted. Farmers who are able to plant crops before water shortages occur receive a larger share of water during rotation because they have a larger share of demand. This trend is particularly clear where head-end farmers are able to plant and establish rice crops. Despite the inequity caused by this management default, this situation maybe more efficient in terms of production per unit volume of water because the irrigated area is concentrated and conveyance losses will be lower than if the whole system is irrigated at a lower cropping intensity. However, this was not a policy or objective in West Java at the time of this activity.

Adopting equity as the primary objective may require greater management inputs from the irrigation agency: head-end offtakes have to be closely monitored to ensure they do not receive more than their fair share, and there will be more gates and structures to be included in the overall gate monitoring program. However, the net result ought to be that more farmers get water for at least some of their land and this has particular merit in places where farmers have limited off-farm income sources during the dry season and where water **users** are expected to pay some or all of the system O&M costs.

Over time, in a well-managed system that has equity as the major objective, these two alternatives will coincide: water will be allocated on the basis of the total irrigable area and farmers will adjust dry-season cropping plans to meet this overall condition.

Rotations can be implemented at a number of different levels in the system. The three most common levels are: rotation within tertiary blocks, rotation between tertiary blocks along secondary canals and rotation between secondary canals (or groups of tertiary blocks) along the main canal.

For rotation at the main system level, the entire system is divided into rotational units comprised of different secondary canals and groups of tertiary blocks. Tertiary blocks in each rotational unit may be scheduled to receive water simultaneously or subrotations between tertiary blocks within a rotational unit may occur between turns of the rotation units. If so, the two levels are usually planned and implemented wholly independently of each other. The arrangement of rotational units largely determines the extent to which crop demand or area equity takes priority. If meeting crop demand is the dominant priority, then each unit should have approximately the same total water requirement. If equity is the main concern, then each unit will have roughly the same irrigable area. Of course, either criterion may be modified to account for the differential effect of conveyance losses according to distances of blocks from the top of the system.

Manageability of the conventional rotation. For implementation of a rotation to be practical and still provide basic access to water, it must be based upon local system design and institutional constraints, rather than on simple administrative boundaries or agricultural quotas. From repeated day-and-night inspections and interviews with PRIS staff and farmers during the 1988 rotation in the Maneungteung System, the following observations were made:

1. The rotation did not have specific objectives or criteria to justify its conventional configuration of tertiary blocks (in fact, the PRIS subsection staff did not know the basis for its origin, which preceded their time in office);

2. Boundaries of rotation units were not always at locations where there was a proper control structure, making it difficult to prevent flows into areas not scheduled for irrigation;

3. The length of a canal section to be filled with water on a single day ranged from **12,458** meters on Wednesdays to **23,074** meters on Sundays, meaning that tertiary blocks at the tail end of long sections were highly unlikely to receive their planned share of water;

4. One case was observed where the upper end of a canal was scheduled for water on one day, drained completely the next day, and then water sent to the tail section on the third day, wasting scarce water in filling and draining canal sections unnecessarily;

5. There were a large number of gates, often in disparate locations, which needed to be monitored and operated;

6. Rotation unit sizes and relative water demand were very unequal and not in continguous units (making control difficult);

7. There was virtually no monitoring by the PRIS of where the water actually went;

8. Gates were often manipulated and canals blocked by self-interested farmers;

9. Staff received no bonuses and had little incentive for the intensive day-and-night tasks required to implement the rotation properly (monthly salaries of irrigation inspectors were the equivalent of about US$40 to US$50 per month plus rice. Salaries for gatekeepers were about US$15, some of whom received rice as well);

10. There was inadequate policing, farmers were not involved; and

11. There was no sanction against water theft, which was very frequent (head-end tertiaries had a higher proportion of observations of unplanned water deliveries). (Detailed data of findings of this study can be found in Murray-Rust, Vermillion and Sudarmanto 1990).

THE POTENTIAL FOR IMPROVING DRY-SEASON IRRIGATION MANAGEMENT

Alternative Approaches to the Crop Plan Process

The following points are suggested by the findings of the Study Team for discussion and for consideration as possible elements in future field experiments aimed at improving the crop plan process.

1. Perhaps 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 of Java and elsewhere in Indonesia.

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

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

4. The official block and system imgation design areas should be either revised 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. It would be helpful for PRIS to initiate a routine program at the section level to take temporary stream flow estimates in the dry and rainy seasons in suppletions or other significant unmeasured water sources which are tapped into irrigation systems, roughly calibrating water depth with approximate discharges.

6. DOI and PRIS need to obtain better or more complete information on palawija crop water requirements, especially for higher water consumptive crops such as red onion. Some 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 and which are low-water consumptive.

An alternative management approach. **An** alternative approach to the current crop plan process would be for the PRIS to restrict its role more to that of managing the supply of irrigation water to the tertiary outlets of its systems. It would be better able to set clear and implementable objectives, for which it retains control and accountability, if it were to focus on acquiring, estimating, communicating, monitoring and delivering agreed water allocations to certain locations and certain times. There would be advantages to having PRIS focus on the water supplying and delivery functions rather than being engaged in trying to get farmers to plant certain crops or delivering water primarily through reaction to the actual crops planted, regardless of the plan or supply. Such a simplified, and more focused role for PRIS in the crop plan process could involve the following features:

1. PRIS 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. PRIS is not particularly adept at closely predicting water supplies in a variable way from year to year (and neither is anyone else). 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.

2. 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 very important for the first and second planting periods of the dry season.

3. 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.

4. 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 them as standing guidelines for coordinating crop combinations within the MAP.

5. 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.

6. Under water scarce conditions where the MAP requirements cannot 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 seascn.

7. 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 be 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.

8. This would eventually become common knowledge and could have the following beneficial effects:

    i. it should help farmers to better assess risks and enhance house hold-level planning for renting and labor arrangements,

    ii. by providing all blocks with priority status periodically, more blocks would have the opportunity, incentive, and security to at least periodically take the risk of investing in higher-value, higher water-consumptive crops during their priority seasons, thereby enhancing equity:

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

    iv. it should increase the system level overall high-value crop production overtime.

9. 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.

10. Under such a scenario the annual crop plan process would not require annual reports from the farmers through PRIS to the section level concerning crop planned forthecoming year. It would be sufficient for PRIS to keep the agriculture service and local government informed about the MSP, MAP, and SACCs, and of possible adjustments to them. PRIS would focus on estimating communicating, and delivering the MSP and MAP. Hence, the objectives would be clear, specific and implementable; the process would be controllable by the PRIS staff themselves (unlike the current situation where the PRIS staff are supposed to have a hand in what crops actually get planted in the field — which is really beyond their control); and each inspector would be clearly accountable to develop the MSP and MAP for the tertiary blocks in his or her area.

Alternative Approaches to Conventional Rotational Irrigation

With the PRIS deciding to develop a more equitable and manageable form of dry-season irrigation than had been used in the past, pilot testing of alternative rotational practices was camed out in the East Maneungteung System in the 1989 dry season. The steps involved in the evolution of the new rotation and its pilot implementationare listed below:

1. Monitor and evaluate the previous rotation system and facilitate conveyance of views among farmers, *KaUr EkBang* (villageagricultural officers) and PRIS staff about problems in the old rotation system;

2. Diagnose causes for the problems identified through data analysis, semi-structured interviews and direct field observation;

3. In discussions with the various actors involved in the rotation, specify the various criteria and objectives expressed for the rotation (such as equity per actual cropped area, equity per irrigable area, practicality of implementation, amenability of the plan to being controlled and enforced);

4. Identify a few feasible alternative rotation plans which optimize various specified criteria or effectively compromise among them;

5. Hold separate discussions on the pilot experiment between the Study Team and PRIS officials at different levels, agriculture and local government officials at the subsection level, and KaUr Ekbang;

6. Hold meeting of PRIS subsection chief and irrigation inspectors to discuss alternative rotation options and agree on one;

7. Hold a meeting of PRIS subsection staff, agriculture and local government officials, and KaUr EkBang to discuss alternatives and select one, sign an agreement to implement it, discuss and agree on joint policing plan involving fanners;

8. Conduct a planning and training meeting among PRIS subsection staff;

9. The PRIS subsection head, in consultation with KaUr EkBang decides on when to start the rotation;

10. Village-level arrangements are made to implement rotating village night guard groups to police the rotation schedule at night;

11. Implement the rotation until harvest of the second dry-season crop in late October; and

12. Monitoring and evaluation of the rotation by the Study Team and production and discussion of **reports** in subsequent meetings with **PRIS** and DOI.

Five alternative plans were developed in collaboration between IIMI and PRIS and the section and subsection level, in the effort to either equalize irrigable area of rotation units, equalize daily demand for water, have a more simple and implementable set of gate adjustments, or have a more controllable rotation.

Each alternative was discussed among the **PRIS** staff and again with **PRIS** staff officials from the agriculture service, the district government and village governments. A public consensus was reached to select alternative three, on the strength of its equity and practicality for implementation.

This alternative had the following characteristics:

1. All tertiary blocks should receive water for one day a week, with no exceptions permitted;

2. Greater equity in area scheduled for imgation each day: the daily variation in total imgable area varied from **564** ha on Tuesdays to ***842*** ha on Mondays a ratio of only **1.49** compared to **3.30** in the **1988** plan;

3. A reduction in the number of times when gates have to be either operated or monitored (i.e., "management inputs") from **279** in **1988** to **241** in **1989** (a **13.6** percent decrease), and a decrease in the number of total required gate operations (i.e., gates adjusted, closed and opened) from **219** in **1988 to 166 in 1989** (a **24** percent decrease); and

4. ***An*** increase in the estimated number of hours per week when gates have to **be** merely monitored to ensure they remain closed — from **16.0** in **1988** to **17.7 in 1989,** a **10.6** percent increase.

Results of the field experiment with the new rotation procedures can also be assessed, relative to the principles of manageability described under ***Manageability* of the *crop plan* process.**

How clear are the objectives?

Prior to the pilot experiment, the new **PRIS** subsection chief was unaware of the criteria used to establish the earlier rotation. It was clear to him and other PRIS staff and farmer representatives that the old approach had many flaws, including its inequity, impracticality, and difficulty of control. In the discussions about results of monitoring the **1988** rotation and altemative plans, the criteria for selecting a new rotation ***were*** identified and clarified, namely that a new rotation should be based on equity of rotation unit areas (not cropped areas or real demand), it should be practical to implement, and it should be subject to management control. Clearly equity of the area sizes of rotational units (with unit size being somewhat inversely proportional to distance from the headworks) was a key objective.

How implementable are the procedures?

The new rotation, which was identified by the Study Team and selected PRIS was substantially easier to implement — in terms of a more efficient and small configuration of gates to be monitored and adjusted. Also boundaries behveen the rotation units were placed where there were adjustable gates. Also, because of the discussions and preparations which were made in advance, the 1989 rotation was able to be implemented much more quickly than in 1988, after discharge levels dropped off. The rotation was not started in 1988 until two weeks after system-level supply dropped below demand; in 1989, this was narrowed to less than one week.

How adequate are the resources?

Given the smaller amount of gate adjustments and monitoring needed under the new rotation, together with the mobilizing of farmers to help in policing the rotation at night, the labor resources were judged to be adequate to the tasks involved. Inspectors generally lived near their areas of work and at least had bicycles for transport, although nighttime use of bicycles to tour the system was considered somewhat dangerous, when done alone.

How controllable is the process?

Realigning rotation unit boundaries according to locations where there were adjustable gates, switching deliveries between rotational units at midday instead of midnight and involving farmers' rotation unit representatives in nighttime policing helped substantially to make the rotation more controllable by PRIS managers. Farmer night watch groups were observed to be functioning on many night inspections. However, partly due to the inadequate incentives of staff, nighttime field work by PRIS staff was probably not as intensive as was apparently needed (judging from the village irrigation issues which still continued in 1989, although at lower levels than before). Although unofficial issues were still frequently observed, they were not as frequent as in 1988, suggesting that some improvement in control was achieved.

How accountable are the staff?

The existence of a formal meeting and signed agreement about the rotation between PRIS and the village agriculture officials was an important factor in strengthening a general sense of accountability to the plan. The meeting enabled the PRIS subsection to discuss the rotation directly with village representatives, which help override more vested interests. The nighttime rotation guard groups (usually consisting of four or five fanners who went around together) usually sought out the irrigation inspector when an illegal issue or closure was observed. This helped make the PRIS staff somewhat more accountable to the water users, although there were reports that the groups often could not locate the inspectors or the disturbances often reoccurred later in the night, even after being corrected by

PRIS staff. Flags were placed at the head of secondaries to designate location of the rotation turn on a given day, thereby helping clarify implementation and making violations more discernible.

How supportive are the incentives for staff?

The average irrigation inspector receives approximately a US$30 to US$40 salary per month, plus a rice allocation. A small field travel allowance is also provided, although there is no difference in this amount between dry and rainy seasons. Unofficial incentives, or temptations to reallocate water according to special interests, can easily exceed the level of salaries. Furthermore, PRIS staff understandably often have sideline income-earning activities which often compete for time.

How measurable are the results?

Actual deliveries to rotation units on any given day could be monitored due to the realignment of unit boundaries according to locations of adjustable gates, nearly all of which had discharge measurement devices. Water adequacy is indicated in this study by the Delivery Performance Ratio (DPR), the ratio between actual and planned deliveries. In 1989, there was a much closer correlation between DPR at the system level and DPR at the level of the rotation unit level ($R^2 = 0.44$), than was the case in 1988 ($R^2 = 0.27$).

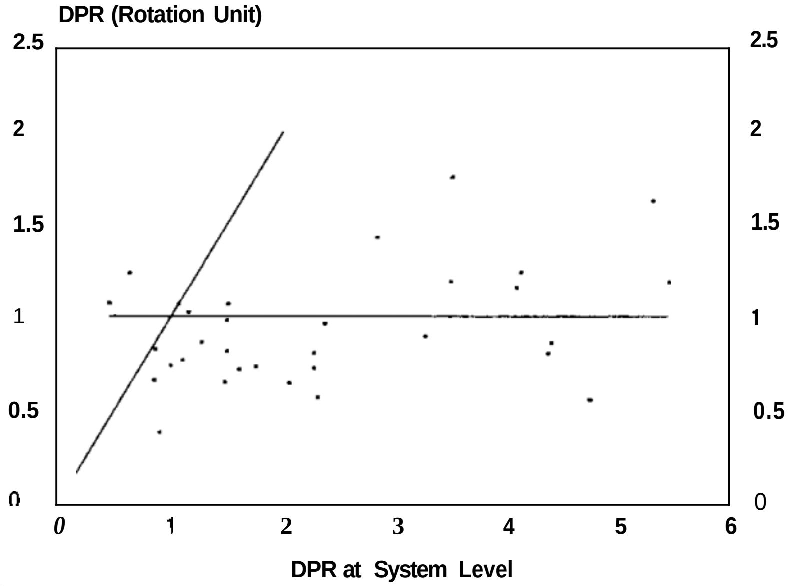
In 1989, whenever DPR was less than 1.0, the scheduled rotation unit received virtually all the water. When DPR was more than 1.0, the scheduled area tended to receive slightly more than its share, but not substantially so (see Figure 5). Surplus water tended to be directed to other blocks not scheduled for irrigation This contrasts sharply with the situation in 1988. There was a much closer link to water management at the main and subsystem levels in 1989. The DPR was introduced to PRIS staff at this level and was discussed during the rotation period as a performance monitoring tool.

The 1989 experimental rotation system is a more manageable one than the prior rotations used in the area in terms of specificity of objectives (especially equity of unit areas), implementability, reduced management requirements and measurability of results. It is somewhat improved in the adequacy of human resources (regarding farmer participation in approving and policing the plan) and control. However, it is not significantly different from the earlier rotation in manageability in terms of the more basic problems of staff accountability and incentives.

This study shows that significant improvements can be made in the manageability and performance of dry-season irrigation rotation at the local level using current resources. These include improvements in aspects such as the configuration of rotation units, scheduling, staff assignments and involvement of farmers in planning decisions and enforcement. However, such adjustments do not address, and by themselves cannot overcome, management control problems connected with weak staff incentives and accountability and the so-called "rent-seeking" patterns of water allocation which are driven by underlying economic and land tenure

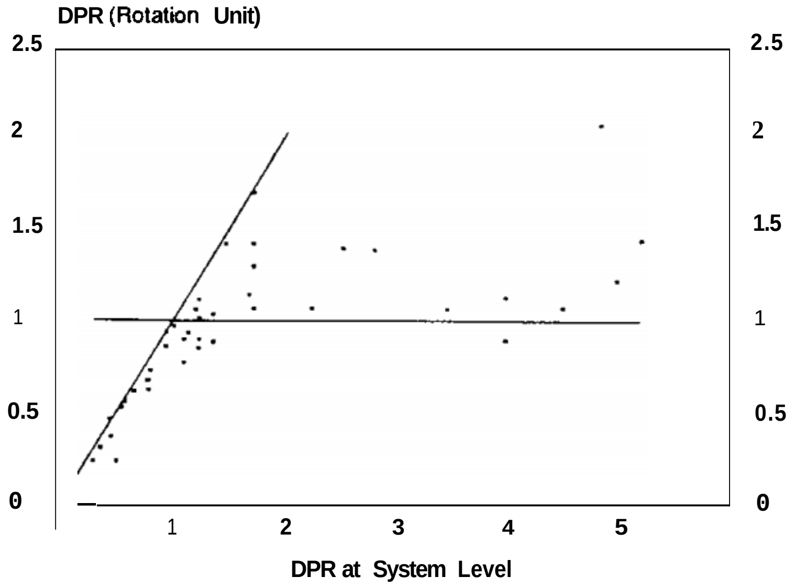
Figure 5. ***DPR at system and rotation unit, East Maneungteung System, West Java***

June – September. 1988



R^2 = 0.267

August – October, 1989



R^2 = 0.437

inequalities and which are especially manifested during periods of scarcity (Repetto 1986). Needed improvements in staff incentives and accountability, sanctions and the adaptability of the PRIS to changing agricultural preferences of farmers will require more basic institutional and policy changes. It is becoming widely recognized that irrigation line agencies around the world, which are funded by general national or provincial revenues, tend to have a weak institutional imperative to achieve and monitor performance objectives (Small et al. 1989).

CONCLUSION

This pilot experiment was an exercise where an international irrigation management organization collaborated with an administrative line agency to develop, implement, and evaluate an improved irrigation management procedure which is based on standard management principles of specifying clear objectives and implementable procedures to achieve measurable results. Line agencies often function less to achieve results than to implement administrative routines as prescribed from above. Frequently, agency staff pay little attention to whether or not the procedures are actually implemented or the results achieved.

In this experiment various new management activities were carried out on the momentum of a pilot research and development project. Study Team members and agency staff discussed equity and management objectives and identified ways to link new implementation procedures to the newly clarified objectives. Farmers were included in designating main system rotation units and in policing implementation. However, the experiment was not able to fully address the more fundamental problems of control and incentives. In order for this "management approach" to be sustained by the implementing agency its own institution must be reoriented toward a "need to manage," which is based on an institutional imperative to clarify objectives and achieve results. This more difficult challenge remains to be addressed.

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