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Research Report

An Assessment of the Small-Scale Irrigation Management Turnover Program in Indonesia

Douglas L. Vermillion, Madar Samad, Suprodjo Pusposutardjo, Sigit S. Arif, and Saiful Rochdyanto

International Water Management Institute

Research Reports

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Summary

The purpose of this study is to assess the results of the Small-Scale Irrigation Turnover Program in Indonesia. In 1987, the Government of Indonesia adopted a policy to turn over to water user associations (WUAs) the management of all public irrigation systems—from the intake to drainage facilities—in the country, which are 500 hectares or less in service area. The primary interest of the government in the turnover policy is to lighten its cost burden for the irrigation subsector while enabling farmers to sustain and even improve the productivity of irrigated agriculture through the mobilization of their own local resources. Generally speaking, the primary concern of farmers (in a context where there is no volumetric water charge) is to maintain or increase the returns per unit of land and labor.

This report examines to what extent these aspirations of the government and the farmers were realized through the turnover program. The report analyzes the impacts of management turnover on irrigation management and irrigated agriculture in selected small-scale systems in West and Central Java. Impacts measured include costs of irrigation to the government and the farmers, quality of irrigation operations and maintenance, agricultural productivity, financial and economic viability of irrigation systems, and social implications of management turnover. The key research questions are: “To what extent has the turnover of irrigation systems from the government to the farmers directly affected irrigation system management?” and, more broadly, “To what extent has irrigation system turnover had an impact on the performance of irrigated agriculture?”

This study is part of a comparative research program to examine the impacts of irrigation management transfer in several countries using a common methodology (Vermillion et al. 1996). The International Water Management Institute and Gadja Mada University in Yogyakarta, Indonesia collaborated in this study.

The Small-Scale Irrigation Turnover Program has led to modest efforts by farmers to improve management efficiency and responsiveness. Turnover has not increased the costs of irrigation to farmers (at least in the short run). Water distribution in the four case study systems tended to either improve or remain positive after turnover. However, it is apparent that significant future expenditures loom in the future unless the current observed underinvestment in maintenance by farmers is halted. No significant changes were observed in agricultural performance or in the economic returns per unit of land and water. The modest outcomes and lack of significant impacts of the program can be explained by the high levels of agricultural production already achieved and the modest and partial nature of the reforms in Java.

The study recommends comprehensive, radical reform of irrigation management, since a series of modest efforts at improvement has not proven effective in improving performance or ensuring financial and physical sustainability of irrigation. Regional Indonesian irrigation services should be restructured towards a support service, with a regulatory and water basin focus, with financing coming increasingly from payments for services delivered rather than from government allocations. The threat of deterioration can be overcome by replacing periodic rehabilitation with ongoing incremental infrastructure improvements jointly financed by the government and the farmers.

WUAs should be granted clear water rights, the freedom to federate to the system level, control over infrastructure improvement and the right to admit nonirrigator water users as members. The turnover process should include farmer representatives in the organizing process as well as enhanced monitoring and evaluation. Where needed as part of turnover, rehabilitation should follow rather than precede the formation of the WUAs.

An Assessment of the Small-scale Irrigation Management Turnover Program in Indonesia

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Introduction

Purpose of the Study

In 1987, the Government of Indonesia adopted a policy to transfer the management of all public irrigation systems in the country that are 500 hectares or less in service area to WUAs. These systems constitute about 21 percent of the total design area and 70 percent of irrigation systems in the public sector. The primary interest of the government in the turnover policy is to lighten the cost burden to the government for the irrigation subsector while enabling farmers to sustain and even improve the productivity of irrigated agriculture through the mobilization of their own local resources. The primary concern of farmers (in a context where there is no volumetric water charge) is to maintain or increase the returns per unit of land and labor.

This study examines the extent to which the aspirations of the government and farmers were realized through the turnover program. The report deals with management turnover in the context of small-scale irrigation systems in Indonesia, and relates this to impacts on irrigation management and irrigated agriculture in selected systems in West and Central Java. Impacts measured include costs of irrigation to the government and farmers, quality of irrigation operations and maintenance (O&M), agricultural productivity, financial and economic viability of irrigation systems, and social implications of management turnover. The key research questions are, "To what extent has the turnover of irrigation systems from the government to farmers directly affected irrigation system management?" and, more broadly, "To what extent has irrigation system turnover had an impact on the performance of irrigated agriculture?"

Although irrigation management transfer (IMT) is now a policy in many developing countries, at present there is a shortage of comparative evidence at the international level to answer these questions (Vermillion 1997). This is part of a comparative research program of the International Water Management Institute (IWMI) that examines the impacts of IMT in several countries, using a common methodology (Vermillion et al. 1996). IWMI and the Gadja Mada University in Yogyakarta, Indonesia collaborated in this study.

Study Methodology

This case study is part of a larger research program assessing the impacts of irrigation management transfer in different countries, including Colombia, India, Indonesia and Sri Lanka.[1] It documents basic information on the turnover policy and on the program and implementation process at the national and operational levels.

Observed results of turnover can be divided into *outcomes* and *impacts*. By *outcomes* we mean the direct effects of turnover on irrigation management. These include practices and

[1]See Samad and Vermillion 1999; IIMA and IWMI 1999; Vermillion and Garcés-Restrepo 1998.

achievements in operations, maintenance, financing, disputes and staff disposition. Pertinent outcome indicatorsinclude relative irrigation supply, irrigation intensity, functional condition of infrastructure, cost of irrigation, ratio between cost of repairing damaged structures to average annual maintenance expenditures, financial solvency of irrigation organizations, frequency of water disputes and average service area of management staff. *Impacts* are the longer-term effects of turnover on the performance of irrigated agriculture and the relation between costs and benefits of irrigation to farm families. They include such indicators as cropping intensity, crop yield, and gross value of agricultural output per unit of land and water. Data collection and analysis were based on five key hypotheses about the relation between irrigation management turnover and outcomes and impacts. These are listed as follows:

1. Irrigation management transfer will induce changes in system management practices that will improve management efficiency and responsiveness to farmer irrigation requirements.

2. Management transfer will bring about improvements in the quality of irrigation operations and maintenance, and will result in sustainable infrastructure maintenance.

3. Other agronomic factors being more or less equal, turnover will be followed by a discernible improvement in agricultural productivity of irrigated agriculture.

4. Management transfer will increase the cost of irrigation to farmers.

5. Other economic factors being more or less equal, turnover will be followed by an improvement in the economic returns per unit of land and water.

The study employed two kinds of comparisons of differences in performance:

- before and after turnover (for the four selected systems in West and Central Java), and

- with and without turnover (for comparing performance according to a small set of indicators for a larger set of systems in both provinces).

Four systems were selected for intensive analysis: Cipanumbangan and Cinangka II irrigation systems in West Java and Kaliduren and Planditan systems in Central Java (figure 1). These systems were selected because of their larger-than-average service areas and because they are amongst the earliest systems to be transferred. The longer post-turnover period would provide better insight into outcomes and impacts. In the early part of the transfer program, systems selected by the government for turnover tended to be the smaller ones. The selection of the larger systems available from this early cohort for this study was done so that these systems would represent more typical systems that would be turned over eventually. Table 1 gives basic data on the selected systems and annex 1 gives further information about the systems.

Data were collected from key informants among farmers and irrigation agency staff, from walk-through inspections of irrigation networks, from discussions among farmers, from a formal survey questionnaire for farmers and from secondary data kept by the Departments of Irrigation and Agriculture. Informant interviews were primarily used to obtain qualitative and historical information about the turnover process and management context and about changes that were made in management practices as a result of turnover.

The walk-through inspections were used to obtain data on the functional condition of the irrigation network and the cost of repairing

FIGURE 1.
Study locations in Java.

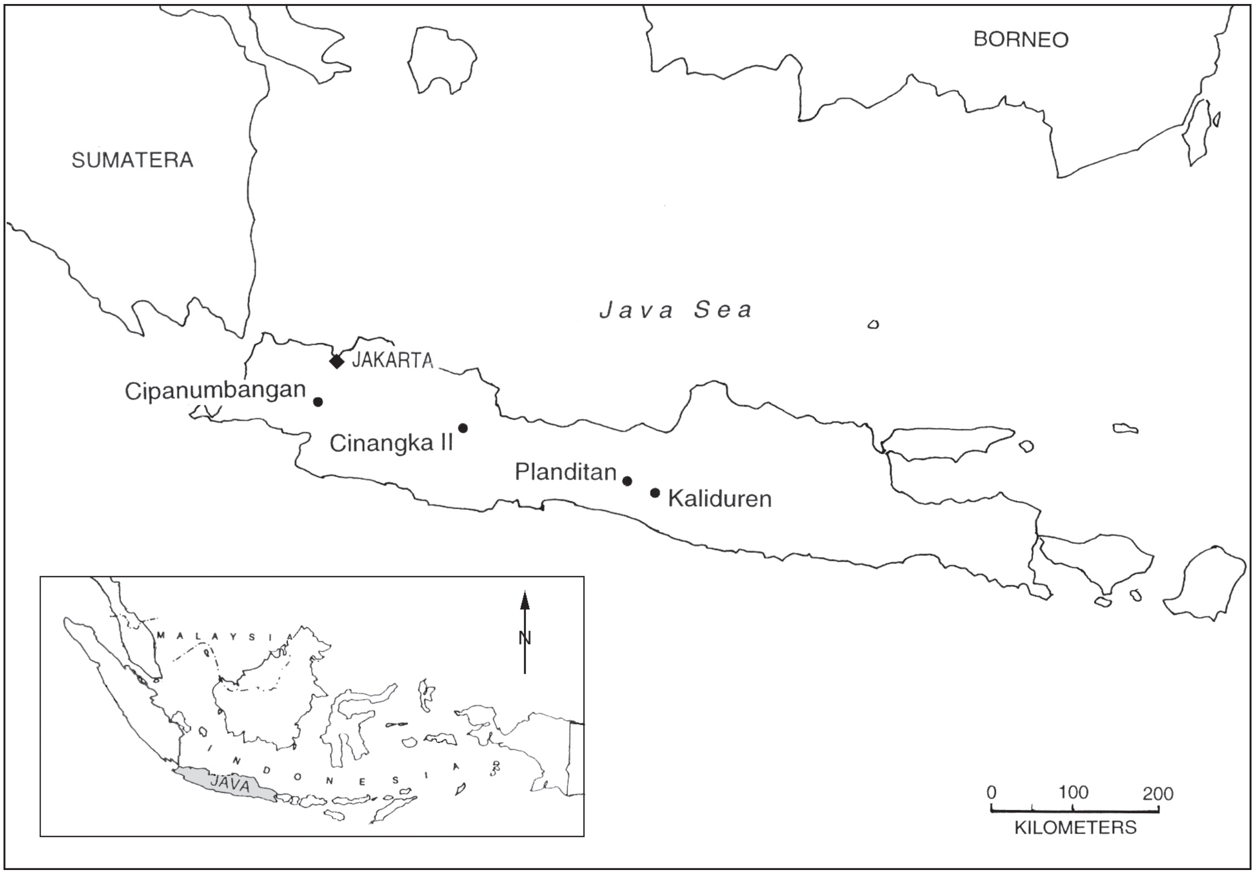


TABLE 1.
Basic data of irrigation systems selected for the study.

	Planditan	Kaliduren	Cipanumbangan	Cinangka II
Province	Central Java	Central Java	West Java	West Java
Year built	1918	1918	1970	1980
When turned over	October 1992	October 1992	June 1990	June 1990
Design area (ha)	131	193	150	441
Irrigated area (ha)	68	190	150	430
Water user association	Harapan Jaya	Guna Tirta	Guna Mekar	Cibadugawiru
Main soil type	Latosol	Latosol	Latosol	Latosol
Main crop(s)	Rice	Rice	Rice	Rice
Water source	Klopo river	Kodil river	Cibojong river	Citaal river
System type	River diversion	River diversion	River diversion	River diversion
Turnout type	Sluice gates	Sluice gates	Sluice gates	Sluice gates
Irrigation structures	42	51	22	49
Lowest water measurement point	Main canal	Main canal	None	Main canal
Average annual rainfall (mm)	3,034	3,199	3,021	2,059
Length of main canal (km)	4.4	7.0	6.0	2.5
Total length of canal network (km)	4.4	7.2	6.5	7.8
Area served/length of canal (ha/km)	15.5	26.2	23.1	55.1

damaged structures. The farmer survey elicited data on farmer perceptions of performance before and after turnover, crop yields, and costs of irrigation. Farmers were selected by random sampling, stratified by distance from the main water intake. Using layout maps, each system was divided into three blocks (head, middle and tail). Farm parcels in each block were given numbers and parcels were selected randomly within each block with the aid of a table of random numbers.[2] Secondary data (where available and checked for reliability) were used to compare irrigation intensities, yields, productivity and profitability of irrigated agriculture between two sets of irrigation systems in both provinces: turned-over and non-turned-over systems. Data on water irrigation issues were obtained from the records available with the irrigation agencies. For the extensive data sample, several irrigation systems were deleted from the sample because of unreliable data. The time line observed for the quantitative performance indicators was 5 years before turnover and 5 years after turnover (if this much time had elapsed). Statistical tests of significance were done to analyze differences in levels and trends of key quantitative indicators. Information on the management context and turnover process in the four irrigation systems was obtained from farmer key informants and field operations staff of the Sukabumi and Kuningan District Irrigation Services of West Java and the Bogowonto District Irrigation Service of Central Java.

Small-Scale Irrigation Turnover Program in Indonesia

Irrigated Agriculture in Indonesia

Agriculture contributes 16.5 percent to the Indonesian gross domestic product and employs 44 percent of the labor force. The total crop-harvested area in Indonesia is approximately 11.44 million hectares. This has been growing at a rate of about 187,000 ha/yr. during the early 1990s. The most important agricultural crop is rice. Of the 9 million plus hectares of rice farmland in Indonesia, nearly 71 percent is irrigated.[3] Nationwide, average rice yields are in the range of 4 to 6 tons/ha. After rice, other major irrigated crops are sugarcane, maize, legumes, tomato, chili, onion and other vegetables.

As a whole, Indonesia has relatively abundant supplies of water. It has 21 percent of the freshwater resources available to the Asia and Pacific region with only 6.2 percent of the population of the region. The average annual rainfall varies between 1,000 mm and 5,000 mm. In 1990, the total average annual water yield for all river basins in the country was approximately 14,000 m^3 per capita. However, due to the high population densities in Java, the average per capita yield is less than one-tenth of the national average in several water basins. Due to rapid increases in population (3 million added per year) and economic diversification, competition for water—between irrigation, domestic and municipal use and industry—is becoming severe in the more densely populated and economically active regions of Java, Bali and Sumatra.

The total irrigated area is approximately 7.1 million hectares, of which about 5.5 million are served by government irrigation systems and 1.6 million are farmer-managed (Soeparmono and Sutardi 1998). Small-scale irrigation is a vital part of the sector, with over 2.1 million hectares of irrigated land being in irrigation systems that serve

[2]Sample sizes were 50 farmers in Kaliduren, 50 in Planditan, 44 in Cinangka II, and 62 in Cipanumbangan.

[3]Farmland is counted as rice land if at least one rice crop per year is harvested.

less than 500 hectares each. This is 30 percent of the entire irrigated area.

Between 1969 and 1994 about 1.44 million hectares of new irrigated lands were created through the construction of irrigation systems. Existing systems serving 3.36 million hectares were rehabilitated, extended or upgraded. During this period, Indonesia spent US$10 billion on irrigation development, 71 percent of which was funded through external loans (Soeparmono and Sutardi 1998).

Between 1974 and 1983, under the Sederhana Irrigation Projects (I & II), the government rehabilitated or constructed 980 small-scale irrigation systems, serving 400,000 hectares in 23 provinces. The word *sederhana* means *simple*, which is how the government originally perceived small-scale irrigation systems during this period. The project was highly centralized and rapidly implemented, which is a characteristic of green revolution programs. Except for a few pilot projects, farmers were generally not consulted about what improvements or structures were needed and were not expected to contribute any of their own equity. Contractors normally carried out construction and the Department of Agriculture was responsible for the development of WUAs.

It is widely recognized that the Sederhana Project was riddled with problems of faulty design and construction. At the system level, following project implementation, confusion frequently arose over whose responsibility it was to maintain and repair structures that had been built by the government. Where sizeable structures had been built, the government often installed a permanent staff and reclassified the system from a village system to a government system, incorporating it into the public inventory of irrigation systems.[4] Even in the systems that had remained as village systems, damaged structures were often left unrepaired for years, because they were irrelevant in the first place, farmers were not organized or willing to make the repairs, or because the farmers and the government thought it was each other's responsibility to make the repairs.

Lack of farmer participation, focus on physical works, and lack of clarity about the status of the systems and responsibility for management have been typical of the organizational culture of government-led small-scale irrigation development in Indonesia. As will be seen below, these characteristics have continued to the present and have apparently created a fundamental inconsistency between means and ends in the Small-Scale Irrigation Turnover Program. Nevertheless, the goals of the green revolution for immediate increases in agricultural production were met and the Sederhana Project was considered a success. The average rice yields in project systems in Java rose from 2.4 tons/ha in 1968 to 4.5 tons/ha in 1983. An econometric analysis has estimated that approximately 16 percent of the increase in yields can be attributed to the enhancement of irrigation systems (Varley 1997).

With the green revolution the problem of low productivity had, apparently, been solved. But the problem of unsustainability of the production system itself was soon to follow. Today's environment is one of rising competition for water and irrigated land, increasing multiple uses of water and growing commercialization of agriculture. Observers argue that unless the WUA is granted stronger legal and political clout (vis-à-vis village governments and private-sector interests), it will be ineffective in dealing with the problems of rising water scarcity and competition (see Ganjar, Avianto, and Bruns 1997) and with the management of irrigation systems for multiple uses. It will be unable to effectively adopt a business orientation and fend for itself in an

[4]By law, all systems with government investment were classified as government systems. Central Java inventoried all systems over 10 hectares and included them in the inventory of government systems.

emerging environment where water will necessarily be treated largely as an economic good (see Helmi 1997).

By the mid-1980s, central and provincial governments were finding it increasingly difficult to finance the recurring cost of O&M for the rapidly expanding irrigation service area. Infrastructure was deteriorating rapidly, which necessitated expensive rehabilitation projects that became recurring events. Farmers were not paying the full cost of O&M. Generally, they considered the management and financing of government-developed systems to be the responsibility of the government. By the late 1980s there were strong pressures on the government to shift from expansion of irrigation to enhancement of irrigation management, with an emphasis on finding solutions to the problem of non-sustainability of irrigation systems.

Turnover Policy

In 1987, the Indonesian National Planning Board (Bappenas) issued the *Government Policy Statement of 1987 on the Operation and Maintenance of Irrigation Systems*. The statement provided new direction for the irrigation subsector. This included mandates to:

- turn over management of all public irrigation systems of 500 hectares or less in service area to WUAs
- introduce an irrigation service fee for farmers in all public irrigation systems
- introduce more efficient O&M procedures in public irrigation systems

The policy for small-scale irrigation determined that all small-scale irrigation systems (defined as those serving less than 500 ha) would be transferred to WUAs by the year 2003. This would affect 2.1 million hectares of public irrigation service area. Systems with service areas of less than 150 hectares would be given first priority. Implementation began in 1987 with pilot implementation of turnover in West Java and West Sumatra.

The policy stated that, after turnover, the WUAs would assume responsibility for O&M of all infrastructure, water delivery and drainage from the intake to fields and drains. For small-scale irrigation, the irrigation agency was to change its role from direct management to the provision of technical and physical assistance and regulatory support. The agency was to restrict its role in direct management to larger-scale irrigation systems and river basins. The policy was ambiguous about who would be responsible for management of weirs and intakes.[5]

The following reasons were given for the adoption of the turnover policy (Soenarno 1995):

- Inability of provincial governments to provide sufficient funds for irrigation O&M.
- Inability of the central government to provide a sufficient subsidy to provincial governments to finance the cost of O&M (it could only provide 50% of the estimated subsidy required).
- The Land and Building Tax and Irrigation Service Fee were not effective and could not be expected to alleviate the government's financial shortfall in the irrigation subsector.
- Management of irrigation systems by the provincial irrigation services was considered to be unsatisfactory.
- Farmers managed many of the small irrigation systems rehabilitated or extended under the

[5]The government has remained flexible on this issue and there is variation in practice between provinces and districts. However, the government often retains staff to operate larger weirs and intakes.

Sederhana Project before the project reclassified them as public systems.

In addition to the above-announced reasons, there appear to be three other kinds of pressure motivating the turnover policy.

First, rice yields on irrigated land had apparently reached their peak by the mid-1980s and it was envisioned that future increases in production would have to come through increases in cropping or irrigation intensity and extension of functional command areas. These increases would depend more on improvements in water management than in production inputs.

Second, by the late 1980s it had already been more than 10 years since rehabilitation of most of the Sederhana Project systems and many were in need of repair (from the point of view of the government). It was thought that the turnover program would provide an avenue through which funds could be mobilized for the repair of small-scale irrigation systems.

Third, through the mid-1990s all turnover activity had been connected with external donor funds. The donors have pushed for this reform and it is questionable whether the government would have implemented the reform on its own initiative. The major sources have been the World Bank (Irrigation Subsector Projects I and II in 10 provinces, and the Java Irrigation and Water Management Project, which covered four provinces in Java) and the Asian Development Bank (Third Irrigation Sector Project, Integrated Irrigation Sector Project, and Nusa Tenggara Agricultural Development Project, Sumatra, Central Java, and Nusa Tenggara).

The immediate objectives of the turnover program clarified in 1991 (Soenarno 1995) were:

- to increase farmer participation in the O&M of small-scale irrigation systems
- to decrease or eliminate the dependence of WUAs on government assistance and increase their overall self-reliance
- to improve the O&M of small-scale irrigation systems

These objectives were not necessarily mutually consistent. The key interest of the government was to decrease its financial burden in irrigation. It was assumed that decreased dependence of farmers on the government would also be of interest to the farmers and would lead to improved management performance. But it remains an empirical question as to whether turnover has been in the financial and economic interest of farmers. We assess the evidence below.

Turnover Process

Priority was given to provinces, which had large concentrations of small-scale irrigation systems. At the field-level, priority was given to systems, which

- were below 150 hectares in area
- did not require heavy repairs (not more than US$100/ha)
- did not have difficult or complex O&M requirements
- had existing WUAs and farmers who appeared receptive to the turnover program
- used water in the systems almost entirely for irrigation

Hence, as is the case in other countries, the government tended to transfer the easier and better performing systems in the early stages of the program. Over time, the program increasingly dealt with more problematic systems.

After a pilot phase between 1987 and 1989, the Ministry of Public Works published an official regulation about implementing procedures for small-scale irrigation turnover and administrative powers of the WUA (GOI 1989). The first step in the turnover process was for the provincial and district irrigation agencies to make an inventory of all eligible systems (Bruns and Atmanto 1992). As farmers were not consulted they had no choice about whether their system was included in the turnover program or not.

Basic data were collected from offices about numbers of agency staff placed in the system, technical level and the functional condition of infrastructure and the existence of a WUA. From these data, provincial and district offices categorized systems into three groups:

- public systems without any agency staff, which would simply be administratively reclassified as farmer-managed irrigation systems (without going through the normal turnover process)

- public systems where agency staff were assigned to help manage the system, but which did not need repair or improvement of infrastructure (which would only receive help in organizing and developing the WUA, to the extent needed)

- public systems where members of the agency staff were assigned to help manage the system and where significant repairs or improvements were needed prior to turnover

After these classifications were made, provincial and district governments prioritized which systems would be turned over in which order and made schedules for implementation. At the district level, annual budgets were estimated with the guideline that an average of US$100/ha would be spent for pre-turnover physical repairs and improvements for the last category of the above-mentioned three systems.

At the system level, a WUA organizer and staff of the subdistrict office carried out a "socio-technical profile." The profile produced a detailed description of the management context and physical condition of irrigation infrastructure. It also included recommendations for what improvements should be made to the infrastructure and "farmer versions" of the design of repairs and improvements, which were simple sketches of structures needed, prepared by farmer representatives. The profile also included recommendations for what organizing efforts were needed for the WUA. One important finding that emerged from the inventories and profiles was that, prior to turnover, farmers were already performing a lot, and often a majority of the management tasks in the systems, regardless of whether or not members of the agency staff were formally assigned to the systems. Hence, for many, and probably most systems, turnover did not constitute a major change in actual management practices.

The profile was followed by the preparation of a "technical version" of the design (which was supposed to be based on the original farmer version) by irrigation district staff or local consultants. This included cost estimates and a work schedule. This was followed by construction, which normally involved the water users as laborers. Although this was not a requirement, farmers often contributed their own labor and materials to add to what the government was financing.[6] Despite the attempts to elicit farmer suggestions for repairs and improvements, it was clear to all that the initiative and financing were coming from the government. Furthermore, there was some uncertainty as to who would be responsible for rehabilitation and modernization of irrigation infrastructure in the future—the government or the farmers.

[6]Farmer contributions were a point of contention with World Bank supervision missions for ISSP I & II. At least during some periods, contributions were supposed to be mandatory, and they were monitored.

These aspects of the process probably did not help reverse the conventional perception among farmers that the irrigation system was primarily the government's responsibility. Farmers who had observed an extended pattern of government-sponsored assistance were not easily dissuaded from their custom of deferring substantial maintenance problems and speculating that the government could easily be enticed to return and make the repairs.

Parallel to the physical improvements, the irrigation institutional organizer and district staff facilitated the organization of a WUA and training in system management. They also assisted with administrative and legal tasks related to formalizing management turnover, which included a formal acknowledgement of the *bupati* (head of the district) and the governor of the province. However, since the WUA was not formally established until after the physical improvements had been made by the government, the group of water users did not have the opportunity to arrive at an official group agreement about the improvements beforehand. This is likely to have reinforced the notion among farmers that the system is not fully theirs and that the government is likely to return again in the future and make other repairs when needed.

At the system level, the turnover process was supposed to be completed within about 18 months, spread over two budget years. This meant that the formation or restructuring of the WUA took place simultaneously with the design and construction of the physical repairs. Reports from key informants and other researchers indicated that several problems or inconsistencies have arisen during implementation of the turnover program. The more significant ones are:

- Crop choices or quotas are often still imposed by local government authorities, despite Basic Law 12 of 1992 about farm cultivation.

- Although farmer consultations were carried out during design, construction was not done in accordance with the design agreed with farmers.

- The irrigation agency has reportedly been "preoccupied" with physical repair works (which are its normal focus) and has given inadequate attention to, and been ineffective in, organizing farmers (for which agency staff have been ill-prepared).

- WUAs (P3A) or their federated representatives are not included as members of the provincial- or district-level *panitia irigasi* (irrigation committee), which has the role of deciding water allocation and use restrictions.

- The WUA is still legally and politically weak although there are mounting pressures for it to exercise more legal clout (such as to require full payment for irrigation costs from all beneficiaries, to settle water disputes, and to invest in agribusiness or agro-industrial ventures as a business cooperative).

- Neither the WUA nor the individual farmers have any legally valid water rights whereby they can defend themselves from increasing competition for water.

- The turnover program has generally been implemented according to rigid administrative guidelines, quotas, schedules, and standard training materials rather than according to a flexible process of negotiation and solving local management problems.

- The agency charged with the responsibility to implement the turnover program is itself the most inclined to resist the change. Due to reluctance or inability to transfer staff, members of the agency field operations staff often remain assigned to an irrigation system even after it has been formally turned over.

- It is apparent that the irrigation service agency has not adopted the role of providing technical guidance to systems after they had been turned over.

It was in 1990 that the first systems in West Java and West Sumatra were turned over to farmer management. The turnover program quickly spread to most of the provinces in Indonesia. The most concentrated attention in the early years was given to Java, where most of the small-scale irrigation systems were located. According to the initial indications, the results of the turnover program were relatively positive, without significant negative consequences (Bruns, Kurnia, and Tajidan1994; Mott-MacDonald International Ltd.1993). However, by 1997, after 10 years of implementation, only 420,000 hectares of small-scale irrigation service areas had been officially turned over to WUAs (Soeparmono and Sutardi 1998). This was only 47 percent of the 900,000-hectare target area, which is supposed to be reached by the year 2003. The program is considerably behind schedule, reportedly due to the decision, in practice, that all systems should have improvements built before turnover, which has resulted in administrative difficulties with contracts, reluctance about the program by the provincial and district irrigation services (which are the primary implementers), disagreements between the government and farmers, and funding constraints.

Turnover Context and Process in Sample Irrigation Systems

The vast majority of irrigation systems in Indonesia are river diversion, surface canal systems. This is particularly true of small-scale systems and of each of the four systems selected for this study. Each of these systems has a masonry weir that diverts water through an adjustable intake gate into a main canal, which is completely or mostly unlined. There is a staff gauge at the intake but there are no discharge measurement devices downstream of the headworks. Water is diverted directly into field channels from offtakes located along the main canal. Overflow structures, silt flushing gates, division boxes, flumes and culverts are the common structures.

At the field-channel level, irrigation and drainage are often integrated in the same channels. Water often flows from field to field. Average farm sizes in Java are only betweem one-fourth and one-third of a hectare. The government estimates that the irrigation efficiencies of such small-scale systems are only about 40 percent to 50 percent. However, this is largely irrelevant at the water basin level due to the extensive and repeated return flows into the river basin between the headwaters and the river mouth.

Table 2 summarizes the powers vested with WUAs and the functions turned over to them in the systems from West and Central Java selected for the study. Because irrigation turnover is a national program, the basic functions and powers devolved are the same between provinces. However, due to differences in scale and complexity of structures, variation occurs between systems in the amount of the hydraulic network transferred to farmer control. In Cipanumbangan and Cinangka II in West Java, the agency continued to control the intakes after turnover. It even continued to exercise partial control over the main canal systems in Planditan, Kaliduren and Cinangka II after turnover. So, turnover is not a singular phenomenon and often involves only a limited degree of devolution of authority and all four systems continued to have some form of joint-management.

TABLE 2.
Powers devolved and functions turned over to WUAs.

Arrangements and function	Planditan	Kaliduren	Cipanumbangan	Cinangka II
WUA is legal entity	Yes	Yes	Yes	Yes
Authority to make rules and sanctions	Yes	Yes	Yes	Yes
Maximum sanction available to WUA	Water stopped	Water stopped	Water stopped	Water stopped
Maximum sanction given since turnover	Warning	Warning	Warning	Warning
Authority for O&M plan and budget	Yes	Yes	Yes	Yes
Authority to set water fees	Yes	Yes	Yes	Yes
Authority to hire or release staff	Yes	Yes	Yes	Yes
Legal water right at level of system or farmer organization	No, govt. allocation	No, govt. allocation	No, govt. allocation	No, govt. allocation
Control over intake	Partial	Partial	No	No
Control over main canal system	Partial	Partial	Yes	No
Control over subsidiary canal system	Yes	Yes	Yes	Yes
Responsibility for future rehabilitation	Yes/NR*	Yes/NR	Yes/NR	Yes/NR
Canal rights of way	Yes	Yes	Yes	Yes
WUA right to contract and raise funds	Yes/NR	Yes/NR	Yes/NR	Yes/NR
WUA right to make profits	Yes/NR	Yes/NR	Yes/NR	Yes/NR

*NR means not yet realized.

In all four systems, WUA became a legal entity and had the authority to make its own rules and sanctions respecting irrigation. The maximum sanction authorized legally is temporary termination of the water delivery service (which, however, may be problematic where water flows from field to field). In theory, the WUA has full authority over O&M, setting water fees, hiring of staff, canal rights of way, entering into contracts, and making profits. No water rights are granted to the association or to individuals. Provisions for the transfer of assets were not implemented. This resulted in ambiguity in the authority of WUAs to carry out improvements to the physical infrastructure.[7] The government allocates water according to administrative rules and priorities. Some of the key tasks carried out during and after transfer in the sample systems are listed in table 3.

[7]It is reported there had been some transfer of assets.

TABLE 3.
Actions during and after the turnover process.

Transfer activity	Planditan	Kaliduren	Cipanumbangan	Cinangka II
Selection of WUA leadership by farmers	Yes	Yes	Yes	Yes
Establishment of WUAs	Yes	Yes	Yes	Yes
Training of farmer representatives	Limited	Limited	Limited	Limited
Training of management staff	Minimal	Minimal	Minimal	Minimal
Improvement of intake and/or main canal	Yes	Yes	Yes	Yes
Repair or improvement of subsidiary network	No	No	No	No
Have farmers helped prioritize improvement?	Nominally	Nominally	Nominally	Nominally
Investment in improvements by farmers	No	No	No	Minimal
Revision of O&M procedures and/or plans	No	Yes	No	Yes
Revision of water charge	No	No	No	No
Reduction or elimination of government financing	Yes	Yes	Yes	Yes
Removal of some government staff	Yes	No	Yes	Yes
Is future responsibility for rehabilitation known?	Uncertain	Uncertain	Uncertain	Uncertain

Management Efficiency, Organizational Viability, and Support Systems

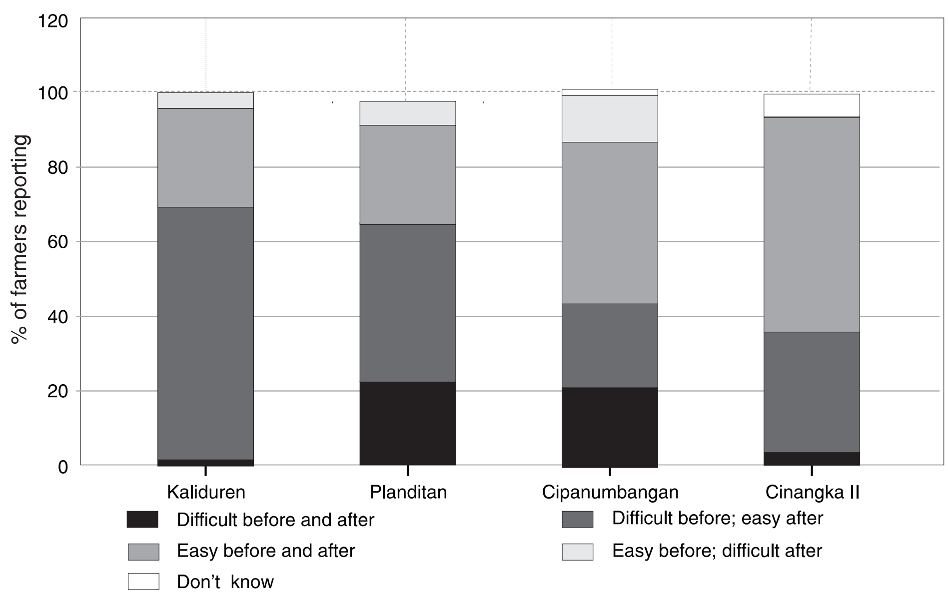
An important concept for management transfer is that devolution of management functions to water users is expected to induce changes in system management practices that would improve management efficiency. This proposition is tested from data obtained from the four sample irrigation systems from the Central and West Java. In this study, two measures were used as indicators of management efficiency. These were:

- the perceived effort needed by farmers to arrange water deliveries to their fields
- the responsiveness of irrigation management staff to farmer suggestions and concerns

In Kaliduren and Planditan in Central Java, 68 percent and 42 percent, respectively, of farmers interviewed perceived that efforts required to arrange water delivery to their fields in the second season had changed from ‘difficult’ to ‘easy’ after turnover (figure 2). About 26 percent in both systems said this was ‘easy’ both before and after turnover. In Cipanumbangan and Cinangka II systems in West Java, between 45 percent and 55 percent of farmers said it was easy to arrange second-season water deliveries both before and after turnover. Twenty to 35 percent felt that arranging water deliveries had changed from ‘difficult’ to ‘easy’ after turnover.

Regarding responsiveness of management staff to farmer concerns, the majority of farmers in Kaliduren and Planditan reported either an improvement in responsiveness or no change, while about 20 percent in both systems reported less-responsiveness of staff after turnover. This may be the perception of those who had special pay-for-service relationships with government staff before turnover. In the Cipanumbangan and Cinangka II systems in West Java, between

FIGURE 2.
Perceived efforts of farmers to arrange water delivery.



60 percent and 75 percent of farmers interviewed reported no change in staff responsiveness after turnover; about 18 percent in both systems perceived an improvement in responsiveness of management staff after turnover.

The term *organizational viability* refers to the post-turnover capacity of the local organization to mobilize the support and resources necessary to continue to meet its objectives in the long run. The indicators that most closely measure organizational viability are:

- farmer support for the organization
- adequacy of fees paid by farmers to the organization
- external legal recognition and political acceptance of the organization

There are reasons to be dubious about the organizational viability of WUAs in Java, which have as their area of jurisdiction the hydraulic service area boundary of a river diversion weir. Survey data indicate that the ratio of farmers who use water from the irrigation system but who have no knowledge of the existence of the WUA (5 years after turnover), and have never joined in a meeting or maintenance activity is 40 percent in the Planditan system, 42 percent in the Kaliduren system, and 30 percent in the Cinangka II system. Over 80 percent of farmers interviewed in these systems did not know about the activities or water distribution arrangements of the WUAs.

Second, there are no fees paid in cash by farmers in any of the four systems. Traditionally, irrigation fees are paid in kind (paddy) to the village irrigation officer and unpaid labor is contributed to seasonal canal maintenance. There are no fees of any kind in the two systems in Central Java and the large majority of farmers interviewed reported that the level of family labor for canal maintenance is the same after turnover as before. In the Cinangka II system in West Java, 65 percent of farmers interviewed reported no change in the amount of payments in kind while 25 percent did not pay fees. Most reported no change in the amount of labor inputs for canal maintenance. In the Cipanumbangan system in West Java, 89 percent of farmers sampled pay fees in kind, of which 59 percent said their fee payments had increased after turnover and 39 percent said they had remained the same. The picture is one of a rather weak and relaxed posture toward resource mobilization. The implications of this for the physical sustainability of infrastructure will be seen in the section on O&M performance below.

Third, the political apparatus of the state comes down to the village level in Indonesia. Except in Bali and a few other local areas, irrigation has traditionally been managed at the local level by the *desa* (the village government). Water-sharing arrangements or disputes between subsections of an irrigation system, which cut across different village boundaries, have been traditionally handled between village governments. This is still the case, even after transfer. Although WUAs may now be granted formal legal statuses, they lack political recognition. Banks are still reluctant to make loans to them. WUAs that cut across multiple villages (which is the case with most systems below 500 ha in service area) still make rotational arrangements and settle disputes through village governments rather than through the formal association.

According to the turnover policy, as the government withdraws from routine O&M it is supposed to take on the role of providing support services to irrigation systems, which have been turned over to farmer management (Bruns and Helmi 1996). These include:

- providing technical guidance for operations
- preventive maintenance and modernization
- facilitating local investment in infrastructure repairs or improvements
- regulating allocation of water along the river course
- managing weirs and intakes
- helping the WUA improve its management procedures

Among the above types of services, so far the only one that has been extended is direct management of the intake. The other support services are not being provided. Reportedly, district governments do not have a clear program and allocate only small budgets for these functions.

Operational Performance

This section examines the impact of management transfer on the operational performance of irrigation systems. It is hypothesized that turnover leads to an efficient and more equitable water distribution and thus increased irrigation intensity.

Water Distribution

Quantitative data on water distribution are not available below the intake in any of the four systems. Therefore, we collected data on farmer perceptions about operational performance before and after turnover. We asked farmers in the sample systems about the five measures of operational performance and how they have changed after turnover, if at all. We paid special attention to the second irrigation season (April/ May to July/ August) since this is a regular but water-sensitive season. The four measures were:

- adequacy of irrigation water supplied to the farm
- fairness of water distribution within the system
- frequency of water distribution conflicts
- timeliness of water delivery to the farm

Figure 3 gives the details on farmer perceptions about system operations in the selected systems. A majority of farmers interviewed in Planditan, Cipanumbangan, and Cinangka II reported no change in water adequacy after turnover, some farmers saying it was adequate both before and after turnover, and others claiming it was inadequate before and afterwards. The exception was Kaliduren, where the majority of farmers reported an improvement in water adequacy after turnover.

Farmer perceptions about the fairness of water distribution were more positive. A majority in all four systems perceived that water distribution was either fair before and after turnover or was unfair before turnover but had become fair afterwards. In Kaliduren and Planditan, between 40 percent and 50 percent felt water distribution had improved from unfair to fair after turnover. In Cipanumbangan, 20 percent felt that water distribution was unfair both before and after turnover, but in the other systems this ratio was much smaller.

It is significant that in all four systems between 60 percent and 80 percent of farmers interviewed perceived that the frequency of water-related disputes among farmers in the system had decreased after turnover. Only a very small number of farmers in any of the systems reported a worse situation after turnover.

Regarding timeliness of water deliveries, the majority of farmers in Planditan, Cipanumbangan and Cinangka II reported no change, although between 20 percent and 30 percent of farmers in Planditan and Cinangka II reported improvement. About 55 percent of farmers in Kaliduren reported an improvement in the timeliness of water delivery after turnover. Another 40 percent reported satisfactory timeliness before and after turnover.

Irrigation Intensity[8]

The annual irrigation intensity between 1991 and 1997 was compared for 66 small-scale irrigation systems in West Java and Central Java: 34 transferred and 32 non-transferred systems.

Figure 4 shows the mean annual irrigation intensities for the two groups of systems during 1991–1996. It is evident that the mean irrigation intensity in the transferred systems is higher than in the non-transferred systems. Regression analysis was carried out to compare the trend in irrigation intensity between the transferred and the non-transferred systems during the period 1991–1996. The regression model fitted was as follows:

$$Y = \beta_1 + \beta_2 D_i + \beta_3 X_i + \beta_4 (D_i X_i) + \varepsilon \quad \text{.............} \quad (1)$$

where,

Y = Dependent variable (irrigation intensity),

D_i = 1 for turned-over systems,
= 0 for non-turned-over systems,

X = Time in years (1991–1996),

β_1 = Intercept,

β_2 = The difference in the dependent variable (irrigation intensity) between transferred and non-transferred systems,

[8]Irrigation intensity is defined as the ratio of the gross annual area irrigated to the irrigable area and is expressed in percentage terms. The design area is taken as the irrigable area.

β_3 = Slope coefficient giving the trend of the dependent variable (irrigation intensity) for the non-transferred systems during the period 1991–1996,

β_4 = Slope coefficient indicating the differential effects of the transferred systems on the trend in the dependent variable (irrigation intensity) during the period 1991–1996, and

ε = Error term.

The following parameter estimates (with t-statistic within parentheses) were obtained using equation (1):

$$Y\,(\text{irrigation intensity}) = 203.79 - 8.118D_i + 2.341.X_i + 5.911\,(D_iX_i)$$

$$(19.72) \quad (-0.582) \quad (0.917) \quad (1.695)$$

R^2=0.045 F statistic = 4.49

The results indicate that there is no statistically significant difference (at the 5% level) in the trend in irrigation intensity during the period 1991–1996 between the transferred and the non-transferred systems.

FIGURE 3.
Farmer perceptions about operational performance.

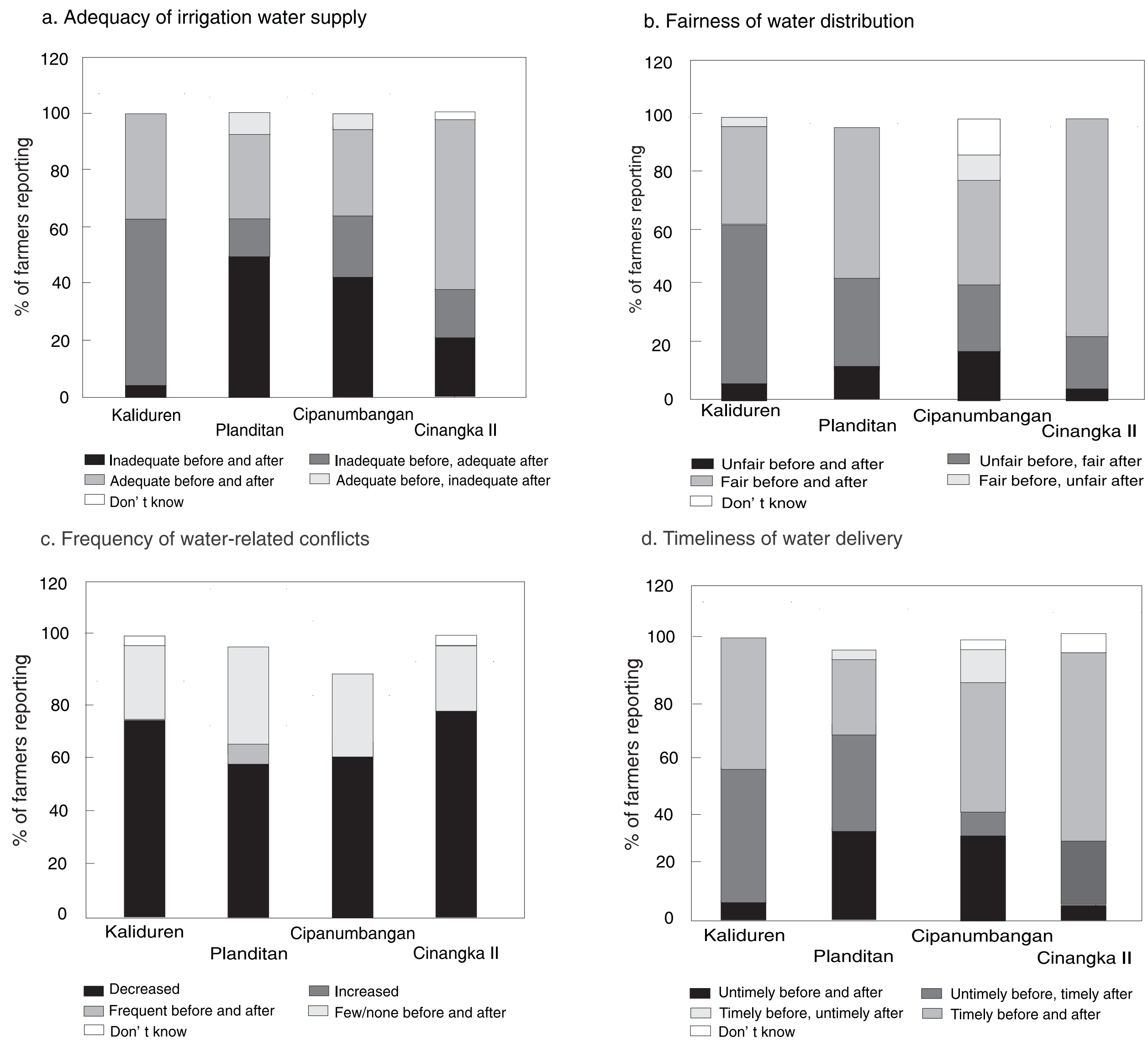


FIGURE 4a.
Trend in annual irrigation intensity of non-turned-over systems, West and Central Java.

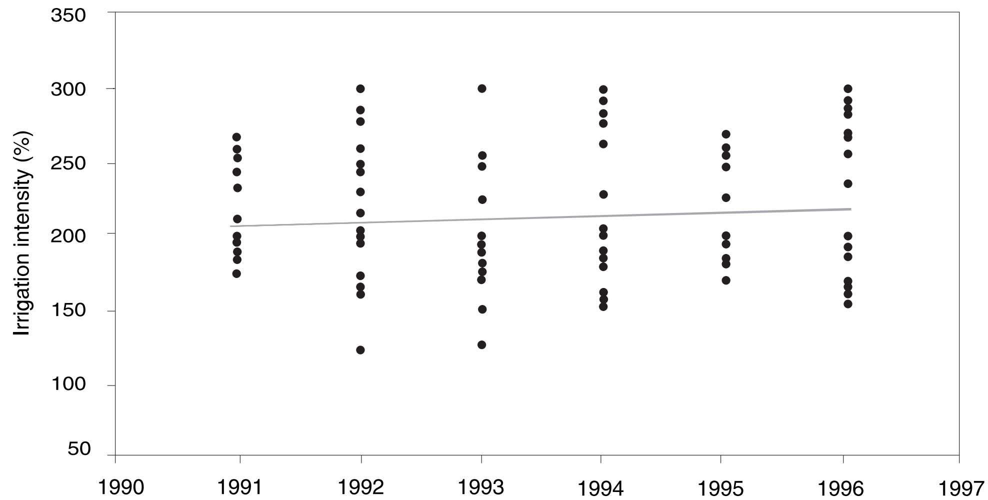
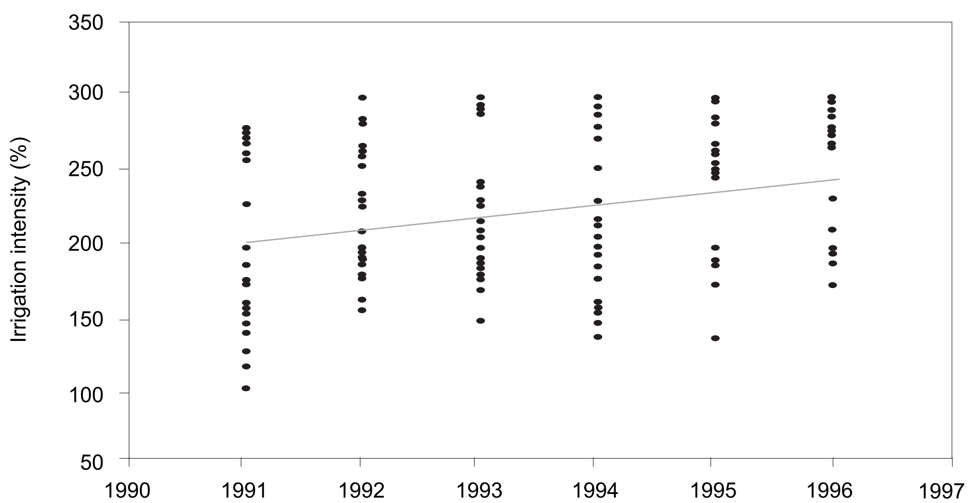


FIGURE 4b.
Trend in annual irrigation intensity of turned-over systems, West and Central Java.



Maintenance Performance

This section assesses the impact of management transfer on the maintenance of irrigation facilities by farmers. It is hypothesized that management transfer will bring about improvements in the maintenance of the irrigation facilities. The proposition was tested by carrying out an irrigation infrastructure assessment survey in the four systems selected for the study. The intake and full length of all main and distributary canals were inspected during the irrigation season in 1997 to determine the functional condition of the infrastructure after turnover. This provides insight into the quality of maintenance after turnover, and, together with data on levels of spending on maintenance, provides an indication of the extent to which the WUAs are keeping up or falling behind in maintenance.

Canal reaches and structures were classified as 'functional,' 'nearly dysfunctional,' and 'dysfunctional.'[9] Canal lengths were considered 'defective' if one of the following problems existed and if it interfered with the desired hydraulic operation:

- constriction or enlargement of the canal cross section
- visible siltation and/or encroachment of freeboard or adjacent road
- visible seepage
- slippage, scouring, or other defects in the embankment
- cracks or other damage to the canal lining

Table 4 shows the percentage of total inspected canal length in each system that was observed to be functional, nearly dysfunctional, and dysfunctional. For three of the four systems, between 93 percent and 96 percent were fully functional and there was only a modest degree of nearly dysfunctional canal length. Cipanumbangan was the only system that had a worrisome amount of nearly dysfunctional canal length (33%). This indicates what can be considered as a lack of preventive maintenance, or conversely, a significant amount of "deferred maintenance."

Control, conveyance, measurement, and ancillary structures were considered defective (i.e., dysfunctional or nearly dysfunctional) if one of the following conditions was present:

TABLE 4.
Functional condition of canal lengths inspected.

District	Total length of canal network (km)	Dysfunctional length (%)	Nearly dysfunctional (%)	Functional length length (%)
Planditan	4.0	0	6	94
Kaliduren	6.5	1	3	96
Cipanumbangan	6.5	0	33	67
Cinangka II	7.8	0	7	93

[9]A *functional* structure is defined as one that can currently perform its basic design function and shows no signs of losing this capacity within about a year. A *nearly dysfunctional* structure is one that is considered likely to become unable to perform its basic function within about a year. A *dysfunctional* structure is one that was unable to perform its basic function at the time of the inspection. For canal reaches, *dysfunctional* means it is unable to convey at least 70% of the desired flow capacity. *Nearly dysfunctional* means it is likely to become *dysfunctional* within about a year.

- scouring of canal around structures

- the approach section, rubble pack, or wings of structures are breaking apart

- the water control structure cannot control flow as intended (due to gates or sills missing, eroded, or damaged, significant leakage at gates, or damaged mechanism of movable structures)

- the water measurement structure cannot be used to measure flow due to a damaged or missing gauge, recorder, or other component

- the civil works of ancillary structures are damaged or poorly constructed

Table 5 shows the number of structures inspected that were found to be functional, nearly dysfunctional, and dysfunctional. In general, the frequency of disrepair is more common for structures than for canal lengths (to the extent the two can be compared). This is probably because structures tend to be movable, more difficult, or impossible for farmers to repair, and their design is sometimes incompatible with farmer principles of water allocation.

In both systems in Central Java only 76 percent of structures were fully functional, and 17 percent to 18 percent were nearly dysfunctional (indicating some deferred maintenance). In Cipanumbangan and Cinangka II, West Java, only 55 percent and 68 percent, respectively, of all structures were fully functional. In Cipanumbangan, 41 percent of all structures were nearly dysfunctional even though physical improvements were made in the system just prior to turnover in 1992.[10] As part of the inspections, cost estimates were made for the repair of all dysfunctional and nearly dysfunctional canal sections and structures in the systems. Dysfunctional canal sections and structures were considered to be an "essential maintenance" cost. Nearly dysfunctional items were considered to be a "preventive maintenance" cost. The accumulation of both was considered as the total deferred maintenance requirement.

Table 6, compares post-turnover average annual maintenance expenditure levels by WUAs with the accumulated deferred maintenance costs. This comparison enables us to estimate the percentage increase in maintenance investment over current levels, which would be required to handle current routine maintenance and take care of all essential maintenance requirements within 1 year as well as all preventive maintenance requirements within 3 years.

TABLE 5.
Functional condition of structures inspected.

District	Total structures in system	Dysfunctional structures (%)	Nearly dysfunctional structures (%)	Functional structures (%)
Planditan	42	7	17	76
Kalidure	51	6	18	76
Cipanumbanan	22	4	41	55
Cinangka II	49	16	16	68

[10]Apparently, this was due to the poor quality of rehabilitation works, which may be an indication that farmers did not play an important role in supervising rehabilitation.

TABLE 6.
Capacity for financing maintenance in systems turned over.

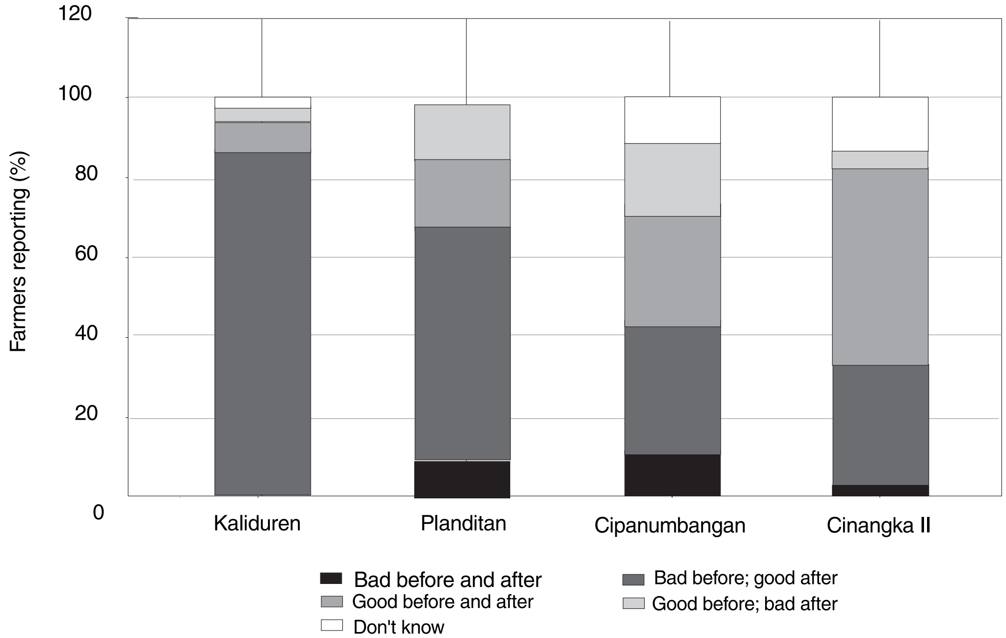
	Maintenance expenditures requirements and (June 1997 US$/ha)	Planditan	Kaliduren	Cipanum-bangan	Cinangka II
a.	Current average annual maintenance expenditure	3.37	11.83	na	13.63
b.	Accumulated essential maintenance cost	22.7	2.24	19.67	17.83
c.	Accumulated preventive maintenance cost	4.51	5.82	2.78	3.59
d.	Total deferred maintenance requirement	27.2	8.06	22.45	21.42
e.	Expenditure required for routine and essential maintenance (in 1 year) and preventive maintenance (in 3 years)	27.57	16.01	20.50	32.66
f.	Required annual budget increase $\left(\frac{e-a}{a}\right) \times 100$	719%	36%	na	140%

*In this context, dysfunctional structures are considered as an essential maintenance requirement. Nearly dysfunctional structures are considered as a preventive maintenance requirement. In Cipanumbangan, WUA representatives did not have data on recent annual maintenance expenditures. na = data not availabe.

In table 6, last row (f) shows that substantial increases in investment would be required in Planditan (719%), Kaliduren (36%), and Cinangka II (140%) to eliminate all deferred maintenance as indicated. Data on current maintenance spending levels for Cipanumbangan are not available, due to lack of records. However, we can see that the cost of eliminating the backlog of deferred maintenance in Cipanumbangan is comparable with those of Cinangka II and Planditan. These findings indicate that, after turnover, farmers have not begun to invest in the long-term maintenance of the irrigation systems. The conventional pattern of farmers deferring some maintenance costs until the government might return with external assistance for rehabilitation has apparently not been overcome by turnover.

The majority of farmers interviewed in the two systems in Central Java reported that the condition of the canal network and structures improved after turnover. Most farmers in the two systems in West Java said that maintenance had either improved or was good both before and after turnover (figure 5). In Planditan and Cipanumbangan, between 15 percent and 20 percent of the farmers interviewed said that the infrastructure was worse afterwards. This was apparently due to some dissatisfaction with the quality of repair work done by contractors prior to turnover. When asked what the most important maintenance problems were, most farmers responded that they constituted the poor condition of the main or distributary canals. WUA leaders interviewed in all four systems reported to researchers that they expected the government would return within 5 years' time to finance another rehabilitation of their system.

FIGURE 5.
Farmer perceptions about canal maintenance in the selected systems.



Agricultural Productivity

This section examines the impact of management transfer on agricultural production. The hypothesis advanced is that irrigation management transfer will result in an improvement in agricultural productivity levels. The hypothesis is tested by comparing crop yields between systems that have been turned over to farmer management and those that are under agency management, and on the basis of farmer perceptions about changes in crop yield before and after turnover in the four case study systems selected from West and Central Java.

Crop Yields

Table 7 gives the mean seasonal paddy yield in the sample of 35 turned-over and 36 non-turned-over systems from West and Central Java during the 5-year period 1991–96.[11] The results of the t-test carried out indicate that there is no statistically significant (at 5% level) difference in the mean yield of paddy between the two groups in the first and the third season. In the second season, the mean paddy yield in the non-turned-over systems is significantly higher than the yield in the turned-over systems.

[11]The yields recorded in the systems in the two selected locations seem to be much higher than the national average yield.

TABLE 7.
Mean paddy yield during 1991–96 in the turned-over and non-turned-over systems.

Season systems	Turned-over systems (tons/ha)	Non-turned-over (tons/ha)	t-statistic
Season 1	6.0 (1.1)	6.2 (1.3)	- 0.796
Season 2	5.9 (1.2)	6.4 (1.6)	- 2.56*
Season 3	5.4 (1.1)	5.2	0.794 (1.3)

*Difference in mean yield between turned-over and non-turned-over systems is statistically significant at the 5 percent level.

The regression model specified in equation 1 was fitted to compare the trend in paddy yields between the two categories of systems during the period 1991–1996. The data were adjusted for seasonal and locational (Central and West Java) variations in yields. Figures 6a and 6b give the trend in the yields during the reference period in the non-turned-over and turned-over systems, respectively. The parameter estimates (with t-statistic within parentheses) obtained were as follows:

$$\text{Yield (tons/ha)} = 5.498 - 1.826\ D_i + 0.0075\ X_i + 0.018\ (D_iX_i)$$

$$(1.738)\quad(-0.461)\quad(0.222)\quad(0.427)$$

$$R^2 = 0.002 \qquad F = 1.470$$

The results indicate that there is no statistically significant difference in the trend in paddy yield between the turned-over and the non-turned-over systems in West and Central Java during the reference period.

Farmer Perceptions about Agricultural Performance

To ascertain farmer perceptions about the impact of management transfer on agricultural performance, farmers in the four case study systems were asked to compare paddy yields after transfer with those obtained before management transfer. Between 60 percent and 70 percent of farmers interviewed in the two systems in Central Java reported an improvement in rice crop yields in the second season after turnover. In the two West Java systems between 70 percent and 80 percent of farmers reported no change in yield before and after turnover.[12]

Financial and Economic Impacts

Cost of Irrigation to Farmers

With the transfer of the management of public irrigation systems from the government to farmers, the latter were expected to mobilize their own resources to meet the cost of O&M of the systems. It is hypothesized that irrigation management transfer increases the cost of

[12]A study by Bruns, Kurnia, and Tajidan (1994) also found most farmers reporting no impact. However, it found that the changes for those farmers reporting changes were substantial enough to suggest significant impacts on yields.

FIGURE 6a.
Trend in paddy yields in non-turned-over systems, 1991–1996.

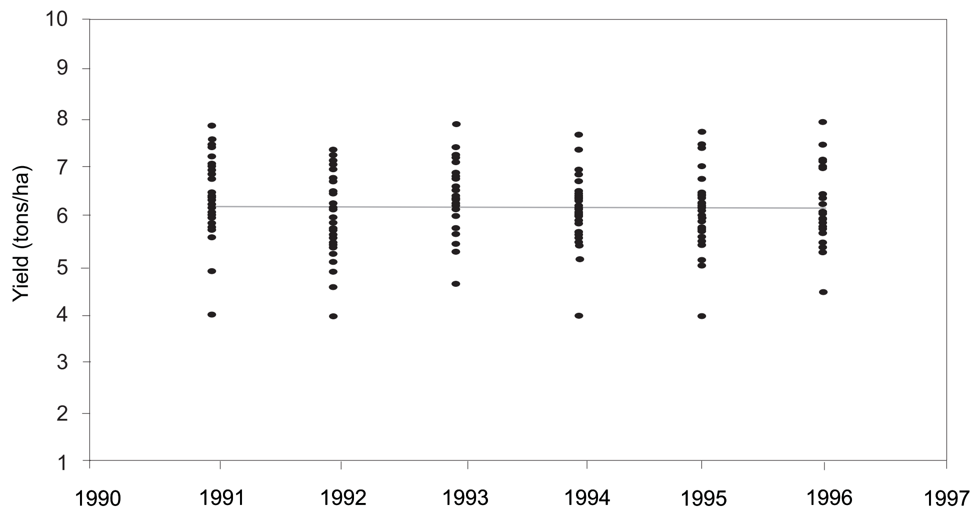
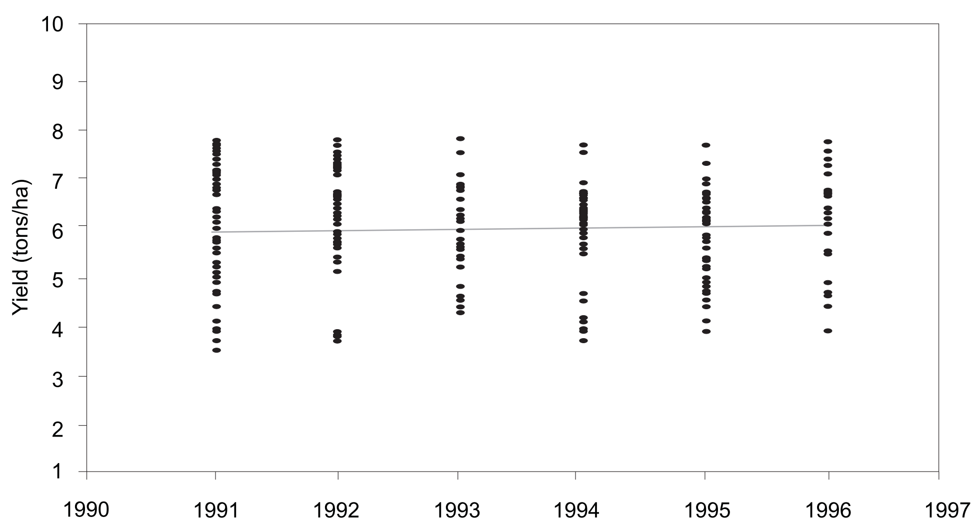


FIGURE 6B.
Trend in paddy yields in turned-over systems, 1991–1996.



irrigation to farmers. In small-scale irrigation systems in Indonesia, water charges paid to the village or WUAs are normally paid in kind (paddy) rather than in cash. In the four systems studied it was found that the associations' records of fees collected and expenditures made were often not complete (which itself is probably an indication of the weakness in financial management). Therefore, the impact of management transfer on the cost of irrigation to farmers was assessed in terms of results of a questionnaire survey conducted in the four systems selected for the study. A sample of farmers from the systems was interviewed about their perception of changes in the costs related to irrigation before and after turnover. The results of the survey are illustrated in figure 7. The proportion of farmers reporting no change in the amount of water fees paid in kind were 45 percent in Kaliduren, 65 percent in Planditan, 38 percent in Cipanumbangan and 85 percent in Cinangka II (figure 7). In Planditan and Cipanumbangan 35 percent and 60 percent, respectively, reported an increase in the fee after turnover. In Kaliduren about 55 percent reported a decrease in the fee. Generally, farmers did not express concern about the reported increases or decreases being worrisome or too dramatic. In Planditan and Kaliduren the village irrigation officer, not the WUA, administers the fees.

Economic Impacts

This section analyzes the impact of management transfer on the gross returns per unit of land and per unit of water, measured in terms of the annual gross value of output (GVO) per hectare and per cubic meter of water diverted. The GVO per hectare was estimated from data obtained for the period 1991–96 from the sample of 35 turned-over and 36 non-turned-over systems in West and Central Java selected for the study.

For the small-scale systems in this study, GVO is a function of crop yields and farm gate prices of paddy. To account for locational variation in farm gate prices, output was valued in terms of the national average price of paddy as the standard. Prices were adjusted for domestic inflation over the period 1991–96 on the basis of the wholesale price index for Indonesia (1995=100) and the gross value of output was calculated in terms of constant 1996 US dollar value.

Figures 8a and 8b illustrate the trend in the GVO/ha in the non-transferred and transferred systems, respectively in West and Central Java. The regression model illustrated in equation 1 (p.15) was fitted with GVO per hectare as the dependent variable and the same explanatory variables as in the equation to determine whether there is a significant difference in the trend in GVO per hectare between the two categories of systems.

The following parameter estimates (with t-statistic within parentheses) were obtained:

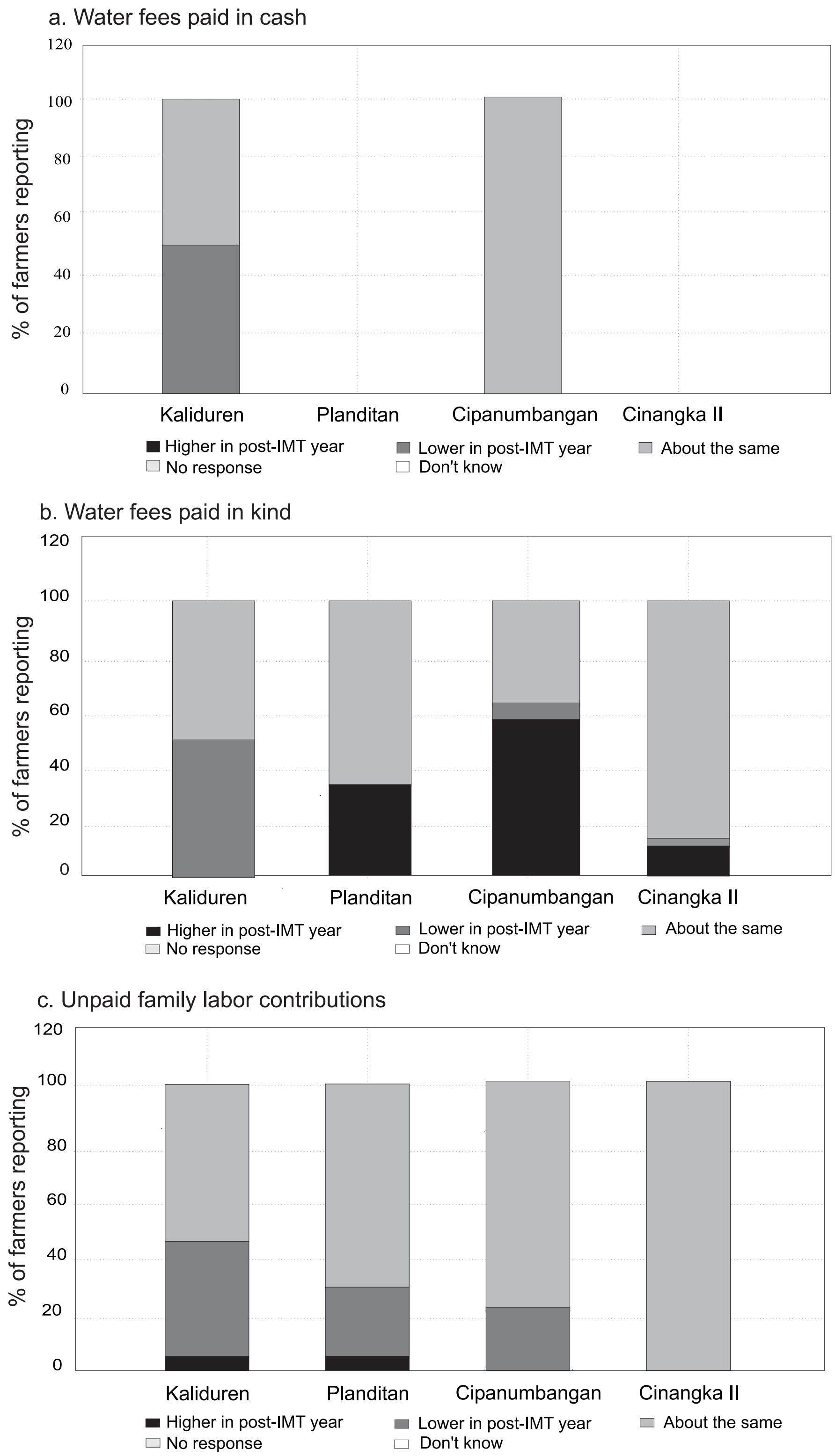
$$\text{GVO/ha(US\$/ha)} = \underset{(19.515)}{2456.37} + \underset{(1.542)}{248.83}\, D_i + \underset{(0.198)}{6.40}\, X_i - \underset{(-0.217)}{8.989}(D_i X_i)$$

$$R^2 = 0.04 \qquad \text{F. statistic} = 9.14$$

The results indicate that there is no statistically significant difference (at the 5% level) in the trend in the gross returns per hectare of paddy between the turned-over and non-turned-over systems during the period 1991–96.

Data on water supply were inadequate to compare the productivity of irrigation water between the two groups of systems. Instead, the analysis was confined to comparing the returns per unit of water diverted before and after turnover in Cinangka II and Cimpanumbangan systems in West Java. Data on water issues in these systems were obtained from the records maintained by the local irrigation agency. Figure 9 illustrates the gross returns per unit of water diverted in the two systems before and after transfer. In Cinangka II, there has been a steady increase

FIGURE 7.
Farmer perceptions about changes in the cost of irrigation.



in the returns per unit of water diverted during the period 1986-1990. It had recorded a drop in 1992 the year of transfer and had shown an increasing trend since then. In the Cipanumbangan system, there has not been an appreciable difference in the returns per unit of water before and after turnover.

Conclusions and Recommendations

Conclusions

In the small-scale irrigation systems in West and Central Java examined in this study, prior to and after turnover, water and land resources were already being intensively exploited. Cropping intensities are relatively high and water is generally recycled and reutilized between systems along river courses. The potential for improving productivity or profitability of irrigated agriculture through changes in irrigation system management is, therefore, relatively limited, and this is a key reason for the lack of substantial improvement in agricultural productivity after turnover.

We have seen that, in Indonesia, irrigation management turnover is not a uniform phenomenon. In practice, it may or may not include replacement of agency staff with local people hired by the WUA, transfer of control over the intake or main canal, and full financial responsibility for future rehabilitation and modernization. Reportedly, WUAs were not given extensive training or empowerment. The Indonesian small-scale turnover program involves only a limited degree of devolution of authority. The WUA has the mandate to operate and maintain the irrigation system from the intake, or main canal, to the drains. But it does not have a formal water right and does not own the irrigation infrastructure (although this may change later).

In general, the WUA is virtually powerless to settle disputes and enforce collection of irrigation service fees in irrigation systems, which cut across multiple villages, the norm in Java and other densely populated areas. Also, the association generally lacks the legal and political clout to mobilize loans and enter into contracts that would permit group involvement in agri-business and agro-industry ventures. Furthermore, it was typical to find in the small-scale irrigation systems in Indonesia that, even before turnover, farmers were already heavily involved in performing a variety of managerial functions, such as channel desilting and cleaning and organizing water rotations in the dry season. However, these functions are often carried out within the context of a cyclical relationship of codependency (farmers rely on government subsidy and, the agency “relies” on deterioration to justify rehabilitation projects). The farmers handle tasks for immediate or seasonal needs while deferring preventive maintenance and letting the government eventually deal with the high cost of rehabilitation. Correspondingly, the agency seeks to attract external funds, which are justified by the deteriorated condition of irrigation systems. Hence, for many small-scale systems, turnover does not constitute a dramatic change in management. The main change is the reduction of government subsidies for maintenance, and possibly, the removal of some or all agency staff from the system. There may be a shift in terms of the agency/farmer relationship but the basic codependent relationship is still in place.

There are reasons why the turnover process, as implemented, may have served more to reinforce dependency of farmers on the government rather than to engender self-reliance. Generally, the WUAs were not formally organized

FIGURE 8a.
Gross value of output per hectare in non-turned-over systems.

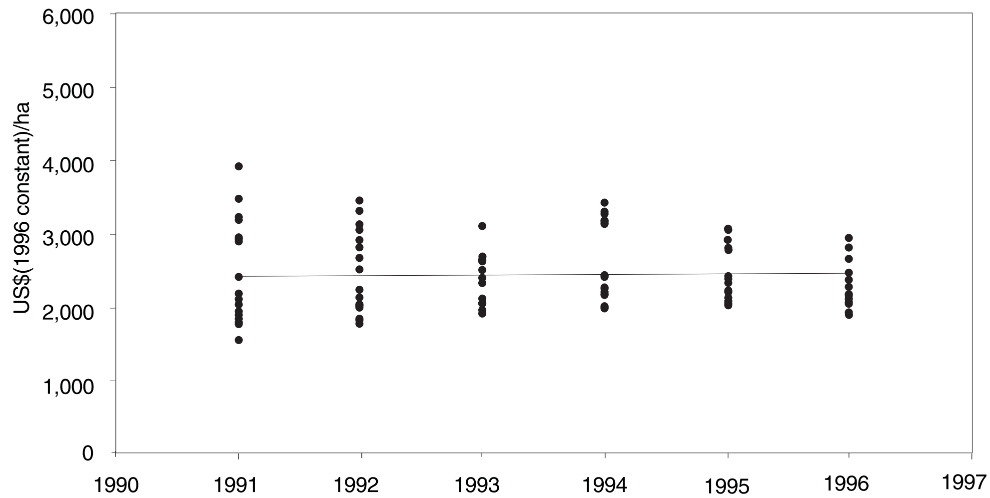


FIGURE 8b.
Gross value of output per hectare in the turned-over systems.

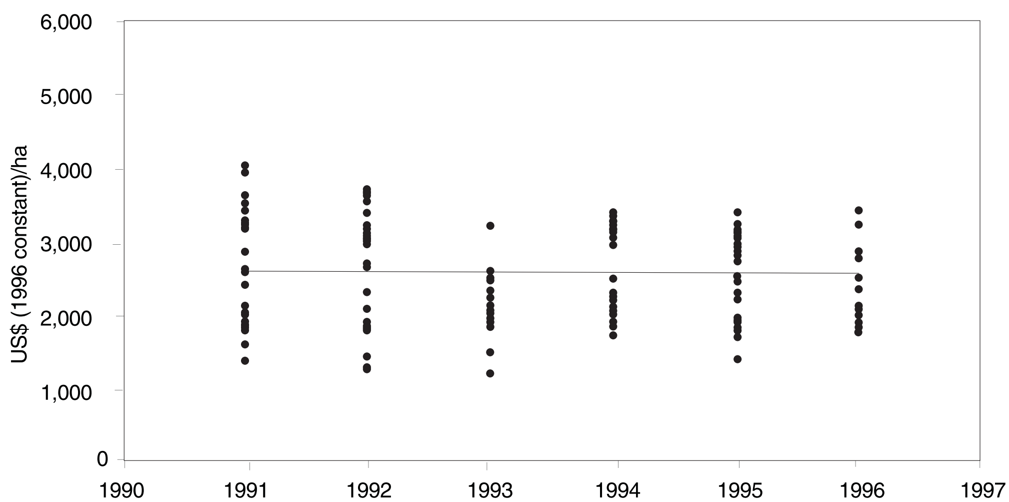
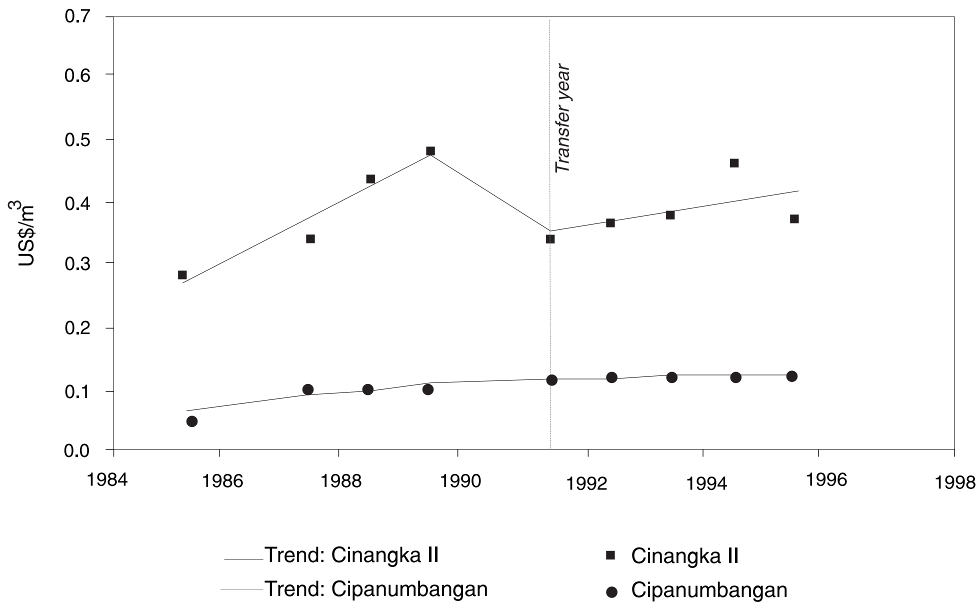


FIGURE 9.
Gross value of output per unit of water diverted (US$/m³).



until after the design and construction of pre-turnover repairs were underway or completed. Nominal inputs are obtained from a few "farmer representatives" about priorities for repairs and improvements and their preferred design. Typically, the large majority of farmers are not involved in planning the physical improvements. The government paid farmers for their labor and generally no local investment was required. Uncertainty remains about whether, or under what terms and conditions, the government may subsidize future rehabilitation or modernization of small-scale irrigation systems.

Farmers in Indonesia have grown accustomed to nearly four decades of nonparticipatory government-sponsored assistance to small-scale irrigation. It is a dubious proposition that the Small-Scale Irrigation Turnover Program, as conceived and implemented, can, by itself, reverse the dependent and speculative attitudes of farmers about their irrigation systems.

In summary, the following factors mitigate against the Small-Scale Irrigation Turnover Program having a substantial impact on irrigation system management or the performance of irrigated agriculture:

- limited amount of authority devolved
- weak position of WUAs
- extensive farmer role in codependent management prior to turnover
- current environmental limits to major advances in the performance of irrigated agriculture
- effects of program implementation on reinforcing dependency of farmers on the government

It is against this backdrop that the findings of this study on the five hypotheses about impacts of management turnover are to be understood. The first hypothesis is that turnover will induce changes in system management practices that will improve management efficiency and responsiveness to farmers. This study indicates that some measures were adopted after turnover by the new WUAs to improve the efficiency of management (improved water distribution arrangements) and to make ditch tenders and association officers more responsive to farmers' concerns. The majority of farmers interviewed reported an improvement in management efficiency and responsiveness after turnover or a satisfaction before and after turnover. This was particularly the case in Kaliduren. Only a very few reported that things had worsened after turnover.

The second hypothesis is that turnover will result in a significant improvement in the quality of O&M of the infrastructure. As with management efficiency and responsiveness, for operational performance, most farmers interviewed reported either an improvement in water distribution adequacy and fairness or satisfaction before and after turnover. Only a very few reported a decline in performance after turnover. The most striking aspect of operational performance was the report by a large majority of farmers in all four systems that water distribution conflicts had decreased. The inspection of the canal network showed the existence of a moderate amount of disrepair and indicated that farmers are substantially under-investing in the long-term maintenance of infrastructure.

The third hypothesis is that turnover will increase the cost of irrigation to farmers. The study indicates that farmers report no significant change in the cost of irrigation to them.

The fourth hypothesis is that turnover will be followed by improvements in agricultural productivity levels. An analysis of the sample of irrigation systems in West and Central Java shows no significant difference in the irrigation intensity and crop yields between systems that have and have not been turned over to WUAs.

The fifth hypothesis is that turnover will be followed by a discernible improvement in the economic productivity of irrigated agriculture. The evidence shows there is no statistically significant difference in the gross value of output per hectare of irrigated agriculture between systems that have or have not been transferred to farmer management. The results also show that in the two case-study systems (Cinangka II and Cipanumbangan), there is no appreciable difference in the returns per cubic meter of water diverted before and after turnover.

In brief, we conclude that the Small-Scale Irrigation Turnover Program has led to modest efforts by farmers to improve management efficiency and responsiveness and most farmers report either an improvement or a continuing positive situation. Turnover has brought about a modest reduction in government expenditure on small-scale irrigation systems. There has not been a general increase in costs of irrigation to farmers, at least, in the short run. Regarding water distribution, the situation in the four case study systems tended to either improve or remain positive after turnover. However, it is apparent that requirements for significant future expenditures loom ahead unless the current observed underinvestment in maintenance by farmers is halted. No significant changes were observed in agricultural or economic productivity related to turnover.

Recommendations

The following recommendations arise on the basis of the findings of this study and evidence from other studies on the irrigation management reforms in Indonesia. We believe that these recommendations are generic in nature and are relevant to many countries besides Indonesia. Similar recommendations have been made for management turnover or transfer programs elsewhere (see Arriëns et al.1996; Merrey 1996; Vermillion and Garcés-Restrepo 1998; World Bank 1993). We recognize that policy recommendations necessarily involve tradeoffs over values and other political considerations relative to which the authors' expertise may not be relevant. Rather than making absolute recommendations, we propose that these ideas be given consideration by decision makers.

1. It is apparent that WUAs need to be granted clear water rights in order to be effective in managing their water, inspiring confidence in their members and staking claims against competing water users along a water basin. Also, WUAs need to have clear authority to repair, redesign or modernize irrigation infrastructure within their areas of jurisdiction. This may be seen as a prelude to a complete transfer of irrigation systems including the ownership of assets.

2. Inasmuch as irrigation systems in densely populated areas of Java increasingly serve water uses other than agriculture, we recommend that research and policy analysis be done to determine whether it is advisable for other kinds of users to also be eligible to become members of WUAs. Excluding alternative water users from also bearing the cost of water will only weaken support for the WUA among irrigators.

3. Currently, the WUAs have no formal representational linkage with the district or provincial government irrigation committees or the new water basin management authorities. Since governments are typically ineffective in regulating water without the participation of local users, we suggest that consideration be given to providing a more substantial forum for WUAs to interact with the government and the larger set of water users from other sectors.

4. To more effectively obtain the support of the majority of farmers for the WUA and to empower farmers to have a more influential role in rehabilitation, it is advisable to fully organize the WUA and obtain binding agreements among farmers regarding establishment of the WUA and implementation of turnover before physical improvements are made.[13] In order to develop the WUA's capacity to invest and enter into contracts, physical improvements prior to turnover should be made in response to WUA's requests for assistance and with known terms and conditions, which require local investment, in labor, local materials or funds.

5. It appears that the use of agency staff as institutional organizers is rather ineffective. Aside from the problem of lack of experience and skills in organizing farmers, agency staff often perceives the turnover program as a possible threat to their jobs or the clout of the agency. Reports indicate that members of the agency staff tend to focus on design and construction and are generally ill-prepared to engage in institutional development activities. We suggest that consideration be given to the low-cost approach used in the Philippines of selecting, training and utilizing articulate and locally-respected farmers as institutional organizers, not as a substitute but as a supplement to agency staff inputs (see Wijayaratna and Vermillion 1994; Raby 1997).

6. To reduce or eliminate farmer underinvestment in maintenance and dependence on government subsidies, a clear policy about future responsibility for rehabilitation and modernization needs to be adopted and communicated consistently to farmers. If the government adopts a policy to provide subsidies for rehabilitation and modernization,

[13]This is the approach that has been followed, historically, by the US Bureau of Reclamation in organizing irrigation districts in the American west. See Svendsen and Vermillion 1994.

and if the government policy is to stimulate local investment, then it may be advisable to create eligibility requirements whereby WUAs can qualify for future government assistance. Such requirements could include:

- proportional matching investment by the WUA
- developing a long-term capital replacement fund by the association
- implementing approved maintenance practices by the association, perhaps to be certified by the irrigation agency or other thid party

7. Implicit in recommendations 5 and 6 is the notion that irrigation service agencies at the province and district levels need to reorient their basic roles from control and implementation for irrigation management to support and regulation, and from irrigation O&M to joint-management and regulation of water basins. Such changes in mandates will require organizational restructuring including changes in staff deployment, skills needed, new forms of financing (based more onpayments for services delivered than central or provincial government allocations), and new incentive systems to motivate the agency towards a service-delivery orientation.

Salient Characteristics of Systems Selected for the Study

Planditan System

Planditan system is located in the Purworejo district, Central Java. It serves 68 hectares of farmland located in four villages (see table 1). Soils are dark brown and reddish latosols and alluvials, located on a relatively flat terrain with an elevation of 120 meters.

The water supply is obtained by diverting water from the upper reaches of the Klopo river by a weir with a gated intake and an open channel canal system. The weir and main canal were built in 1918 during the Dutch occupation. The main canal is 4.4 kilometers long and has 17 field channel offtakes along it, each of which serves an average field-channel area of about 3 hectares.

In this highly fragmented farmland 92 percent of farm parcel sizes are less than 0.14 hectare each. There are 404 farmers cultivating land in the system, of which 96 percent are owner operators. The average annual farm income from these smallholdings is approximately US$130 to $155 per year. Farmers normally cultivate two rice crops per year, and a third between November/ December and August/September. Farms are generally left fallow between late September and early November.

During periods of water abundance, water is distributed by continuous flow throughout the system. During periods of water shortage, normally during the second and third seasons, water is rotated between blocks. Main, secondary, and field channels are cleaned of weeds and partially desilted prior to land preparation for each season. This is done by farmers without pay and is arranged by the WUA or the village governments. These procedures were not changed after management turnover.

During the turnover process, the WUA was legally established and its officers and ditch tenders were provided short-term training. Some repairs were made to the main canal system but farmers were not involved in decision making or investment in the repairs. The government discontinued expenditures for the system and, in October 1992, removed one member of the staff from the system after turnover. Another member remained after turnover and had partial responsibility for managing the intake and main canal. The number of government staff declined from two to one.

Kaliduren System

Kaliduren system is located in the Purworejo district of Central Java. Its service area is 190 hectares, which cuts across five villages. The main crop is paddy, with a small amount of nonseasonal rice grown sometimes if there is a third season. Soils are dark brown to reddish latosols and alluvials on a generally flat topography. The elevation is 152 meters.

The system diverts water from the upper reaches of the Kodil river, using a weir and open channels for water distribution. The weir and main canal were built in 1918. The main canal is 6,942 meters long but the total length of distributary channels is only 300 meters. The system has 3 branch canals and 29 field channel offtakes. Each field offtake has a sliding sluice gate and a discharge-measuring device. The average field chanel block (or tertiary block) area is 5.75 hectares.

The system has 1,090 farm parcles, most of which are highly fragmented, with an overall average size of 0.07 to 0.17 hectare per parcel.

Of the farm parcels 80 percent is less than 0.07 hectare in size. Fifty-two percent of the farmers are owner operators, 14 percent are renters or sharecroppers and 34 percent have received land by allocation from the village for their service in the village administration. The average annual farm income from these parcels was in the range of only $130 to $155 in 1995.

The system has three potential seasons per year. The main rainy season is from October/November through February/March. The second season is from March/April through July/August. In some years, there may be a short third season between August/September and October/November. Paddy is virtually the sole crop during the rainy season and the dominant second-season crop. Groundnuts tend to be the main crop if there is a third season.

During periods of water abundance, water is distributed by continuous flow throughout the system. During periods of water shortage in the second season, water is rotated between blocks. Often during the third season, when water is especially scarce, it is delivered on a first-request basis. Routine maintenance is arranged by the WUA or the village governments and implemented with non-paid farmer labor, as in Planditan. These procedures were not changed after management turnover.

As part of the turnover process, the WUA was established and made legally valid. Since the system traverses six villages (each of which had a WUA before turnover), a WUA federation was established at the system level. However, village-level WUAs asserted their continuing superior authority over the federation and the federation WUA has been weak until the present. WUA officers and staff were given training. Paradoxically, the agency actually increased its staff assigned to the system from two to four after turnover, to improve O&M of the intake and the main canal. After turnover, the “federated” WUA took over the management of the intake and the main canal from the West Java Irrigation Service. Village-level associations took over the management of branch canals or distributary channels.

Cipanumbangan System

The Cipanumbangan system is located in the Panumbangan village in the Sukabumi district, West Java. It irrigates 150 hectares. The average farm parcel size is 0.38 hectare. Main soil types are red and yellow latosol, podsolic and alluvial, located in a hilly terrain, which experiences frequent landslides and soil erosion.

The water supply is diverted with a river diversion weir into open channels. The weir was built in 1970. The main canal is 6,000 meters long and has seven field-channel offtakes along its length, each of which has adjustable sluice gates but no measuring devices. The total distributary canal length is only 500 meters.

There are 101 farm operators in the system. Fifty-two percent are owner operators, 33.5 percent are renters or sharecroppers, and 14 percent have received use rights from the village. Farm parcels are slightly larger in Cipanumbangan compared to the systems in Central Java. Tenancy is also more common. Farmers plant two or three paddy crops per year, with some non-rice seasonal crops grown during the dry season between August and October.

Water distribution along the main canal and field channels is by continuous flow to the field level when supply equals or exceeds demand. Water is rotated along the main canal during periods of pronounced scarcity. The main canal and field channels are cleaned prior to the start of each cultivation season. This is organized by the WUA and is implemented with unpaid farmer labor. These procedures did not change with management turnover.

During the turnover process, the main canal and intake were repaired but without farmer participation in either decision making or investment in the repairs. A WUA was legally established and nominal training was given to farmers. One member of the agency staff was removed from the system while one remained.

After turnover, in June 1990, a new system of rotational distribution was initiated by the WUA at subsystem levels to facilitate planting of more non-rice seasonal crops during the dry season. After turnover, operation of the main canal was taken over by the WUA but the intake was still controlled by the agency. The local in-kind water fee (which was to pay for farmer-level management activities before turnover) was 5 kilograms of unhulled rice per hectare per season between 1985 and 1992. After turnover, the fee was raised to 7.5 kilograms of unhulled rice (paddy) per ha per season.

Cinangka II System

The Cinangka II system is located in the Kuningan district, West Java. It has a service area of 430 hectares and receives water from a river diversion weir and a free intake (with a pumping station). In 1980, the government built the current weir. The network has 6 distributary channels and 18 field-channel offtakes. Water discharge is only measured at the intake. The system has fertile latosol and podsolic soils on a flat to undulating terrain.

There are 1,217 farmers in the system, 80 percent of whom are owner operators. Sixteen percent farm on a leasehold basis. The average size of a farm parcel is 0.2–0.35 hectare. The system normally has two to three cropping seasons per year. Paddy is grown two or three times. Non-rice crops (especially soybean) are sometimes grown in the third season, between August and October. During each season, when water is abundant, it is distributed by continuous flow and, when it is in short supply, it is distributed by rotation (at main-canal or distributary and field-channel levels). After turnover, these procedures did not change and both the intake and main canal continued to be under the control of the agency.

In Cinangka II, the same basic turnover process was implemented as in the other systems. This included physical repair of the main canal system, with limited participation by farmers and village leaders and some mobilized group labor for intake and canal repairs. The number of members of the agency staff was reduced from five to one, and this number was retained to operate the large intake. In meetings at the village level, farmers elected village-level WUA officials, who, in turn, elected overall WUA leaders at the federated level. The WUA was legally established and limited classroom training was provided to its officials. Turnover occurred in June 1990. However, as was the case in Kaliduren, the WUA federation at the system level has been in a weak position relative to its constituent village-level associations.

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