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Farmer Participation in Design and Construction of HPSIS Irrigation Systems in Indonesia

(D R A F T*)

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INTRODUCTION

The High Performance Sederhana Irrigation Systems (HPSIS) component of the Sederhana Irrigation project began in fourteen sites in April 1982, although the agreement formally creating HPSIS was signed in August 1983. Seven other sites were added in January 1984. Activities at all sites are scheduled to continue through December 1985.

HPSIS is funded by the Indonesian Government ($1.067 million), the Ford Foundation ($119,000), and USAID ($1.4 million in loan funds and $2.12 million in grant funds.) Its purpose is to test and refine a participatory approach to developing government-managed small-scale irrigation systems in Indonesia.

Project Strategy and Organization. In order to test the utility of water user participation under different conditions, the project has selected three types of sites for its activities. Together the three sites represent different levels of technical completeness and provide a means of comparing the interactions of physical and organizational development of irrigation.

The first type of site is the least developed physically--both major and tertiary works need to be designed and constructed. At these sites both major and tertiary works are developed with the active participation of the water users. There are two of these sites.

The second type of site is partially complete physically, and in fact represents a large number of Sederhana projects. These sites have the major works already built and functioning, but no official tertiary works. At these (twelve) sites, the tertiary facilities are designed and constructed with the participation of water users.

The third type of site can be considered physically complete--both the main and tertiary works have been constructed and are supposed to be functional. At these (seven) sites, water users did not participate in the original design and construction of the physical structures, but only in the operation and management of the irrigation system that is already in place. In many of these sites, farmers have, on their own, made improvements in some of the physical structures.

Most of the background information in this paper, especially on standard practices of the Ministry of Public Works in doing designs and redesigns, comes from Gunawan Widjaja, Renato Maza, and Cesar Lizardo. Renato Maza and Gunawan Widjaya collected and assembled the raw data. Any errors in interpretation are the author's.

Activities at the 21 HPSIS sites are under the sponsorship of the Ministries of Public Works (MPW) and Agriculture (MOA). All of the sites are supposed to be supervised and monitored by their respective provincial and kabupaten implementation teams, as well as by the central teams, all of which are inter-ministerial. There are six MPW sites and fifteen MOA sites, where community organizers (COs) are financed and supervised through the sponsoring ministry.

Lessons learned from HPSIS to date. Indonesian farmers resemble their colleagues in other Southeast Asian countries in that they are often quite able to develop and manage their own irrigation systems. There are no empirical studies that show either that farmers are generally better able to manage irrigation than the government or that the government is generally better able to manage irrigation than the farmers. Nevertheless many people feel that more farmer involvement in developing government-supported systems will substantially improve those systems. HPSIS offers an opportunity to test this proposition.

One of the important lessons from the HPSIS project to date is that it is both possible and desirable to involve farmers in early phases of irrigation system development. In particular, it is possible to involve farmers productively in the design and construction of small government-supported irrigation systems. With all of the publicity that farmer participation in irrigation has had in recent years, this may not seem worth saying, but it is.

When HPSIS began, farmer participation in government-supported irrigation systems was much talked about but seldom implemented. It was by no means guaranteed that we would be able to involve the farmers in developing and managing the HPSIS systems. Earlier evidence from "normal" Sederhana systems implied that farmer participation was low. Community organizers had been used effectively in the Philippines and Sri Lanka, but not yet in Indonesia. So the demonstrably high amount of farmer participation in HPSIS is something to take note of, especially if other irrigation projects in Indonesia plan to use participatory approaches and COs.

The purpose of this paper is to describe what farmer participation in design and construction means in the HPSIS project. People often talk of "more" or "less" participation without revealing what they mean. The major conclusion of this paper is that HPSIS has increased farmer participation in design and construction. The rest of the paper explains that point. First the standard ways of designing and constructing irrigation systems are discussed. Then these are contrasted with the HPSIS approach. Finally design and construction changes are quantified, and data are presented to support the argument that HPSIS has successfully involved farmers in design and construction.

Future HPSIS reports will look at the subject of farmer participation in irrigation from still different sides. For example, what are the characteristics of farmers who participate in important irrigation activities and decisions? What are the characteristics of water users' associations whose members are active in the management of

their irrigation systems? Those questions are important when future "participatory" irrigation projects are designed and when project sites need to be chosen.

One very important (perhaps the most important) set of questions remains to be examined. That is, what are the benefits from all of this farmer participation? At this point, we have tentative evidence that farmer participation in early phases of system development pays off in better-run systems. But the data are incomplete. Future reports will discuss the impact of increased participation on the quality of HPSIS irrigation systems and the quality of irrigation in those systems.

1. Standard practices in doing surveys and designs.

In theory, informal proposals for irrigation systems come from the farmers. (In fact, proposals are usually made by government officials.) They are supposed to discuss the general idea among themselves and then with various local government officials. The proposal then gets reviewed at higher levels of government, along with other proposals from other farmers. As the proposal moves up through the government system, it receives a ranking according to how well it meets certain criteria and according to how it compares to other proposed sites. Eventually a ranked list of project proposals is sent to the Provincial Public Works office and the provincial governor.

The Provincial Bappeda (planning board) makes a final ranking of all the proposals in the province. Then this ranked list is sent to the Central Public Works office. Site characteristics are included with each proposal. These characteristics, and the provincial rankings, are fed to a computer, from which a new set of rankings emerges. This ranking is used to decide which proposed areas will be surveyed during the coming fiscal year in preparation for design.

Tenders for survey and design are let either in Bandung, where most of the design contractors are located, or in the provinces (the practice varies). Firms bid for contracts that include several survey/designs. When the contracts are awarded, the firm sends a survey team to the province and surveys the areas that are its responsibility under its contract.

There is usually very little farmer input into the surveys. According to numerous reports, farmers often do not know when the surveyors will arrive. If farmers and surveyors happen to meet in the field, it is either by chance or the meeting is limited to a small number of farmers who may or may not represent other farmers.

Survey maps are drawn to a scale of 1:5000, which is often not accurate enough to reflect topographic variation. (More detailed maps, for example, drawn to a scale of 1:2000, would provide more information, but also would cost more to produce.) When the maps are completed, they are brought back to Bandung (if that is where the firm is from) and the

design teams prepare designs. The same firm that does the survey also does the design, but different teams from that firm may be involved at each stage. The designs are submitted for review to the Sub-Directorate of Technical Planning in Bandung. Designs that are approved are then sent to the Provincial or Seksi (sub-provincial) Public Works office.

The following fiscal year, the designs may be proposed for construction, or they may be proposed in subsequent years. Regardless of when they are proposed for construction, the designs are almost never field checked before construction begins. (An exception is mentioned below.) Once again there is a ranking of all projects proposed for construction. Criteria for selection include some agricultural and economic data, which are supplied by Ministry of Public Works (MPW) Seksi and the Provincial Agricultural Service. The project data are again sent through MPW/Province to the central computer, which helps the central MPW office make the final selection of projects that will be constructed.

MPW/Jakarta forms provincial appraisal teams to evaluate the projects that have been selected for construction. The teams comprise relevant government agencies: MPW, the Provincial Agricultural Service, and the Ministry of Transmigration if the projects are in a transmigration area. The appraisal teams make the final selection of sites for construction.

2. Design Revision. The designs may or may not be revised during this long process, which may take several years from the time the project is first proposed for survey until the construction actually begins. Designs can be revised for several reasons. The first is budgetary. MPW/Jakarta approves projects individually and year-by-year from project lists that the provinces send. How much of a particular project gets funded in a particular year is determined in Jakarta. Jakarta may change its funding decisions, which may require project design changes.

A second reason for revising designs is that new information from the field may make the original design inappropriate. The most likely source of new field information is a field visit that may occur during the tendering for construction. During tendering, the prospective contractors may visit the field with staff from the MPW Seksi. If the prospective contractors agree that the design needs to be changed before the bids are offered, the design will be changed. Only rarely do changes made under these conditions reduce the cost of the construction. Only rarely do farmers' suggestions play a part in changing designs.

Designs that are revised for budgetary reasons are almost never adjusted to take into account new information from the field. Moreover, people who do these redesigns almost never go to the field to see whether (a) the original design fit the field conditions, or (b) changes have occurred in the field that require changes in the design. Instead they rely on reports from the appraisal teams or reports made from the field visits made during the tendering for construction.

During construction the design may change again because contractors or farmers who happen to be present think changes are necessary. The major limit on design changes at this stage is the value of the contract,

which cannot be exceeded without renegotiation between the contractor and MPW. The changes themselves or the time required to make them may affect costs.

During the time between survey and construction, certain things are unlikely to change at the site. These include topography, rainfall, and soil conditions. Other things are likely to change within several years, however. These include the economic situation (costs and availability of inputs, value of crops that are actually grow and that are expected to be planted), the social situation (number of farmers, tenancy, land ownership patterns), the agricultural situation (land use patterns), and the availability of water (depending on what's happening upstream from the site).

3. Design and construction in the HPSIS project.

The HPSIS project handled early system development much differently from the pattern described above. Community organizers (COs), who were specially selected and trained, were assigned at the HPSIS sites well before construction was supposed to begin. The COs were recruited, selected, and trained by staff from LPEES (Lembaga Penelitian, Pendidikan, dan Penerangan Ekonomi dan Sosial—Institute for Social and Economic Research, Education, and Information), an Indonesian non-government organization.

The CO role was originally conceived as non-technical, and the people recruited and trained as COs had non-technical backgrounds. They were at least high school graduates. The most important qualifications of the first group was their motivation and ability to learn organizing techniques. The idea was that the CO should limit his activities to stimulating and facilitating interactions between farmers and government.

All of the sites where construction was planned already had been surveyed and their irrigation systems had already been designed. But HPSIS allowed for and in fact encouraged re-design with the participation of farmers. There were two kinds of encouragement. The first was that HPSIS grant funds paid for re-design. The second was that the GOI must certify in writing that the farmers understand and accept the final design. USAID will not reimburse any construction work whose design was not acceptable to the farmers.

The COs help the farmers participate in system design and construction through water users' associations (WUAs). While technical aspects of design, survey, and construction are discussed by the CO at those sites that have construction, he or she (there are a few female COs) also helps farmers to think about and interact on issues of future O&M and water management. After the systems are completed, farmers are expected to know that it is up to them to take care of the tertiary facilities, use the available water in the best and most agreeable way, and resolve their conflicts with a minimum of outside assistance. The COs are supposed to help prepare the farmers for these post-construction activities.

Experience has shown, however, that the COs should also have a good background in more "technical" areas, especially the COs who are assigned in sites where construction is being done. Farmers often rely on COs for technical information. If the COs cannot provide the information themselves, they are expected to know which government agencies to contact for advice. Further, the COs are more able to work effectively with MPW engineers and private contractors if they have some understanding of technical matters. The CO training and selection has thus become more technically oriented than originally envisioned because the COs themselves have found that they are more effective with such backgrounds.

On arriving at their sites, the COs spent their time meeting farmers and generally getting to know as much about the the local situation as they could. At the same time, they began to encourage farmers to think systematically about how the irrigation system could best serve them, and to help the farmers organize their choices so that they could be presented to MPW or contractors coherently.

Part of the COs' early organizational work included preparing simplified maps that showed the planned location of structures and canals according to the existing design. The purpose of the maps was to help farmers understand the implications of the design for their own farms. The designs were then reviewed by the farmers and COs.

The next step was for farmers, COs, MPW, and contractors to meet to discuss the designs. Sometimes these meetings were held in the field and other times at the MPW office. During the meetings, farmers' presented their suggestions for design changes to MPW and the contractors orally or in writing or both.

Agreement between farmers and MPW/contractors had to be negotiated, either at the meetings or sometime afterwards. This agreement could cover both the design and the construction. It often included which parts of the system would be built by farmers and which by outside labor, wages for skilled and unskilled labor, whether any labor would be donated by the farmers, and for which parts of the system.

In only one HPSIS site the contract had already been awarded before the COs had a chance to begin their work. Since contractors have to stay within budget and time, this meant that farmers at that site had little chance for revising the existing design. Even in sites where redesign is possible before contracts tendered and let, however, there are time constraints because MPW needs to disburse funds according to Government of Indonesia (GOI) budgetary regulations.

As is the case with Sederhana sites, additional design changes were made during construction. The difference between the HPSIS sites and Sederhana sites is that these changes were negotiated between the farmers and the contractors. In one particular case (in NTB) [Morfit paper], the negotiations lasted for quite a long time, and were ultimately decided the way the farmers wanted.

4. <u>The data</u>: Kinds of changes recommended and effected by farmers.

We have measured changes in design and construction by first breaking the irrigation systems into several parts. These are (1) the dam, (2) the main canal, (3) main system structures, (4) tertiary and quaternary canals, (5) tertiary and quaternary structures, (6) animal crossings, (7) inlets, and (8) access roads. This system of classification is similar to that used by MPW to keep track of system parts in the Sederhana Project. From original design maps, we counted the numbers of structures in each category except for the canals, where we recorded their actual length. Using CO reports and other sources of information, we then classified farmers' suggestions and the final design (after "redesign" was negotiated between farmers and MPW) in the same way. The same system was used to keep track of construction. Thus we know "how much" of the system was constructed by the contractor, how much by farmers with pay, and how much by farmers without pay.

There are two reasons for analyzing system design and construction in this way. First, using similar data for Sederhana systems, we can quantitatively compare HPSIS and Sederhana systems in terms of farmer participation in design and construction. Such a comparison will help add some precision in discussing "levels" or "amounts" of participation in HPSIS. A short-term objective of HPSIS was to "increase" farmer participation in design and construction. Now we have a way of measuring whether we've succeeded.

A second reason for this analysis of participation in design and construction is to see how different "kinds" of participation are related. Both Public Works and USAID are interested in having farmers participate in certain kinds of activities. These include paying irrigation fees, maintaining tertiary works, solving water-related problems, distributing water among themselves. It is also thought desirable to encourage farmers to participate in building the systems. HPSIS was designed to see whether farmer participation in those activities can be increased by having farmers participate in survey and design.

I should add that bringing farmers effectively into the development of government-supported irrigation systems is potentially quite difficult. Farmers are often suspicious of government projects and reluctant to get themselves involved. It is by no means self-evident to farmers that they should be involved in government-managed irrigation development simply because they stand to benefit from the completed systems. Governments have learned this through many experiences with many different kinds of projects that have tried unsuccessfully to involve farmers. Farmers have also learned that a government project may not deliver all it claims, and that their involvement in a government project may turn out to be a waste of time. HPSIS's success in generating farmer involvement in a variety of activities and decisions therefore has lessons for other projects that also want farmers' interest and commitment.

The data base for this paper comprises four kinds of sites. The first is a group of seven sites under the Ministry of Agriculture (MOA), where there was no HPSIS construction (MOA-SM sites). These sites are called "system management" (SM) sites. The second is a group of seven sites under the MOA where there was construction of tertiary and quaternary works (also called on-farm works, or OFW, in this paper). These sites are called "system development and management" (SDM) sites. The third group of seven sites began in 1984. Six are under the Ministry of Public Works (MPW) and one is under MOA. Construction is taking place at all of them. They are called "1984 sites" in this paper. The last group of sixteen sites are all Sederhana systems that were built several years ago. There are two Sederhana sites from each HPSIS province. They were not chosen randomly, but they were also not chosen on the basis of any particular criteria. They are included because we had certain data on them that allowed comparisons with the HPSIS sites.

This paper concerns only participation in design and construction, with construction including rehabilitation and canal lining in some cases. This restrictive definition excludes other physical improvements (more properly called maintenance) made to the systems during the past few years, and in many cases these were done mostly or entirely by the farmers.

5. Design changes. Design changes are restricted to MOA-SDM and 1984 sites only. The design changes took place between the original design, which was made from the original survey, and the design that was used during tendering of construction contracts. (There was no HPSIS project design or construction at either the MOA-SM sites or the Sederhana sites.) So numbers of cases will be small. Data include sites at which no design changes took place. Keep in mind that the main system (MS) design changes were probably not negotiated, except for two of the 1984 sites. This is because, except for the 1984 sites, design and construction followed the pattern described above, which usually does not include much input from farmers.

The mean values in the following tables are actually of "absolute values" (i.e., the number without its sign) of the changes. Absolute values were used so that the size of the changes would be emphasized. Some of the changes were really negative. In other words, the original design may have called for 5000 m of canal, but this eventually became 4000 m. The absolute value of the real change (-1000 m) becomes 1000 m. The standard deviation is a measure of how much variation there is in the variable. The standard deviation and the mean should be looked at together. High standard deviations, especially relative to the mean, indicate that there is lots of variation in the variable. In other words, the variable's mean is only a very rough way to summarize the variable.

Table 1. Design changes.

Main system canal (meters)

mean	97.833	std dev	113.751
minimum	0.000	maximum	264.000
valid cases	6	missing cases	31

Main system structures (number of pieces)

mean	1.286	std dev	3.402
minimum	0.000	maximum	9.000
valid cases	7	missing cases	30

Drainage Canals (meters)

mean	484.333	std dev	516.100
minimum	0.000	maximum	1250.000
valid cases	9	missing cases	28

On-farm Canals (meters)

mean	3617.636	std dev	5057.222
minimum	0.000	maximum	16730.000
valid cases	11	missing cases	26

On-farm Structures (number of pieces)

mean	6.200	std dev	6.680
minimum	0.000	maximum	18.000
valid cases	10	missing cases	27

Table 1 shows that MS changes are small relative to changes in other parts of the system. For example, the average change in design of main system canals was only about 100 m, while the average change in the design of on-farm canals was about 3600. The changes in the MS were also small relative to actual MS construction (for which data are not presented here). For example, the average change of 100 m in MS canals corresponds to an average actual construction of 3500 m.

This paper will concentrate on design and system changes at the OFW

level, since that's where HPSIS's activities were focused, that's where farmer participation was more pronounced, and that's where farmer participation will be encouraged in the new Small-scale Irrigation Management project. There are similar data for other parts of the system (crossing, inlet, farmroads), but they will not be considered in this paper.

Table 2. Design changes in the on-farm system, according to the kind of site.

Design Change, On-farm Canals (meters)

	mean	std dev	number of cases
All Sites	3617.636	5057.222	11
MOA-SDM	1016.000	1234.854	4
1984 site	5104.286	5896.827	7
total cases = 37	missing cases = 26		NS

Design Change, On-farm structures (pieces)

	mean	std dev	number of cases
All Sites	6.200	6.680	10
MOA-SDM	2.250	2.872	4
1984 site	8.833	7.387	6
total cases = 37	missing cases = 27		NS

Table 2 shows the design changes (in OFW) that occurred at the four types of sites. It shows that there was more design change at the 1984 sites than at SDM sites. (Analysis of variance was done on the patterns in table 2 and all subsequent tables. The analyses of variance are not included in this paper. The letters "NS" mean that F scores were not significant at the 95% confidence level.) This makes sense for several reasons. Our latest group of COs were better prepared, and generally had more time to work with the farmers during the design period than the COs at the MOA-SDM sites. Another factor is that HPSIS was entirely new to the provincial Public Works staff when the SDM sites were being designed. By the time the 1984 sites (which include two in NTB and two in South Sulawesi) were started, the provincial staffs already had some experience with HPSIS and therefore had some idea of what to expect from the farmers and COs.

Table 3. Design changes in the main system, according to the kind of site.

Design Change, Main system canal (meters)

	mean	std dev	number of cases
All Sites	97.833	113.751	6
MGA-SDM	57.667	99.882	3
1984 site	138.000	132.408	3
total cases = 37	missing cases = 31		NS

Design Change, Main system structures (pieces)

	mean	std dev	number of cases
All Sites	1.286	3.402	7
MGA-SDM	0.000	0.000	3
1984 Sites	2.250	4.500	4
total cases = 37	missing cases = 30		NS

As can be seen by comparing table 2 to table 3, there were more design changes in the on-farm works than in the main system works (which include primary and secondary works and are abbreviated MSW). This is not surprising since we encouraged farmers to review the OFW designs and to make suggestions for changing them, whereas there was no opportunity for farmers to change the MS designs. Another reason is that the OFW are closer to the farmers' concerns and probably closer to their knowledge of "micro environments." Also it is probably harder for farmers to agree on a MS change than on several OFW changes. A MS change will probably affect more farmers than an OFW change. Several small changes for several smaller groups are easier to bring about than one large change that has to be agreed on by a large group.

6. Total construction. There is no reason to expect that the sites will differ from one another according to their construction status. There is in fact very little difference in the number of on-farm structures that were built at the sites (table 4). There are some differences in construction of on-farm canals, however. One possible explanation is that the Sederhana systems are larger, on average, than the HPSIS systems.

Table 4. Construction of on-farm works broken down by type of system.

Total construction, on-farm canals (meters)

	mean	std dev	number of cases
All Sites	15859.375	17433.933	24
MOA-SM	355.000	312.036	4
MOA-SDM	16176.750	6380.130	4
1984 site	11983.500	12546.196	2
Sederhana site	20752.214	20350.204	14

total cases = 37 missing cases = 13

Total construction, on-farm structures

	mean	std dev	number of cases
All Sites	21.692	14.513	26
MOA-SM	5.750	5.500	4
MOA-SDM	24.800	14.342	5
1984 site	25.000	18.385	2
Sederhana site	24.467	14.172	15

total cases = 37 missing cases = 11 NS

7. Total changes in the design, from the original design to construction of the works. Designs are originally made from surveys. As was mentioned previously, designs can be changed for many reasons before construction actually begins. The reasons for the changes can be "external" to the project, such as budgetary, political, or bureaucratic factors. Or there can be project or site-related factors that can change designs. These include the realization by MPW or its contractors that local conditions have changed, or negotiations with farmers.

Table 3 summarized those pre-construction changes in designs. The designs can be changed again after construction begins. Table 5 shows total changes in the design. These are the changes that were summarized in table 3 (pre-construction changes) plus changes that occurred during construction. Other things being equal, HPSIS sites should show greater design-to-construction changes than normal Sederhana systems because their negotiated changes will be on top of the "normal" or "externally caused" changes that usually take place in Sederhana sites. Table 5 show that this holds for on-farm canals but not for on-farm structures.

Table 5. Total design changes in on-farm works, broken down by type of system.

Total design-to-construction change, on-farm canals (meters)

	mean	std dev	number of cases
	810.389	1442.857	18
MOA-SDM	573.333	858.215	3
1984 site	3426.500	2505.279	2
Sederhana site	462.615	1008.826	13
total cases = 37	missing cases = 19		

Total design-to-construction change, on-farm structures

	mean	std dev	number of cases
All Sites	12.105	33.633	19
MOA-SDM	0.750	1.500	4
1984 site	3.000	0.000	1
Sederhana site	16.000	38.774	14
total cases = 37	missing cases = 18		NS

8. Construction by farmers. One of our short-term objectives in HPSIS was to involve farmers in constructing parts of their irrigation systems, although this is not the usual practice. According to standard government regulations, MPW must contract out for construction work. In addition, some MPW staff feel that farmers are unable or unwilling to do the work. But evidence from communal systems shows that farmers often are both willing and able to dig canals and help set turnouts, etc.

Farmers have done a significant amount of construction at the HPSIS sites. Sometimes they work without pay; other times they have negotiated vigorously with the contractor for their wages. Farmers do not always want to help construct their systems, however. Sometimes they are content to let contractors, even outsiders, do the work. For example, in NTB, a specialized team of Javanese laborers were imported to one project site to do dig a canal through solid rock. Other reasons for farmers' not working on construction include lack of time, better paying alternatives, or the low status associated with the work.

Table 6. Amount of farmer-constructed on-farm canals (meters), by type of system.

	Length of on-farm canals constructed by farmers		
	mean	std dev	number of cases
All sites	5214.682	7567.028	22
MOA-SM	355.000	312.036	4
MOA-SDM	9790.750	5446.920	4
1984 site	11513.500	13210.876	2
Sederhana site	4259.417	7805.032	12
total cases = 37	missing cases = 15		NS

Table 7. Number of farmer-constructed on-farm structures, by type of system.

	Number of farmer-constructed on-farm structures		
	mean	std dev	number of cases
All sites	3.080	8.026	25
MOA-SM	4.500	3.512	4
MOA-SDM	4.200	5.762	5
1984 site	19.000	26.870	2
Sederhana site	0.000	0.000	14
total cases = 37	missing cases = 12		

Tables 6 and 7 show the amount of on-farm canals and number of structures built by farmers in the HPSIS and Sederhana systems. In general, there has been more farmer participation in construction at the HPSIS sites than at the Sederhana sites used for comparison. In addition, the absolute amount of farmer-constructed structures has been increasing as the project has matured. (This conclusion is soft, however, since we have data from only two of the seven 1984 sites.)

Two things need to be noted about those tables. First, none of the construction at the SM sites is part of HPSIS, but is something that the farmers, COs, and MPW have had to work out among themselves. No HPSIS funding supported any of the SM construction, but the HPSIS project

encouraged just this type of self-motivated activity. Second, four of the sixteen Sederhana sites had padat karya work on the OFW, and the OFW were substantial. Padat karya is an Indonesian Government program that pays local people to work on infrastructure projects. In general, only a very small percentage of Sederhana projects were constructed with padat karya funds. The amount of construction at the Padat Karya sites used for comparison in this paper was higher than the HSPSIS average. All of this means that the farmer participation in construction for the Sederhana sites is overstated. Even so, it is less than at the HPSIS sites.

Table 8. Percentage of on-farm canals constructed by farmers, broken down by type of site.

Percent on-farm canals (meters) constructed by farmers

	mean	std dev	number of cases
All Sites	0.532	0.469	23
MOA-SM	1.000	0.000	4
MOA-SDM	0.652	0.316	4
1984 site	0.849	0.214	2
Sederhana site	0.303	0.473	13

total cases = 37 missing cases = 14

Table 9. Percentage of on-farm structures constructed by farmers, broken down by type of site.

Percent on-farm structures constructed by farmers

	mean	std dev	number of cases
All Sites	0.219	0.385	26
MOA-SM	0.904	0.192	4
MOA-SDM	0.213	0.295	5
1984 site	0.500	0.707	2
Sederhana site	0.000	0.000	15

total cases = 37 missing cases = 11

9. Percent of construction done by farmers. Tables 6 and 7 showed the actual amount of construction that the farmers took part in. Tables 8

and 9 show the percentage of total on-farm construction that was done by the farmers. It is clear that the rates of participation in the HPSIS sites were higher than in the Sederhana sites. Note that the highest percentages were in the SM sites, where the construction was in a sense outside of HPSIS. The farmers built all of the additional on-farm canals and 90% of the on-farm structures that were added to their systems.

10. Relationships among different kinds of farmer participation in construction and design. There is quite a bit of variation in the levels of farmer participation in the HPSIS and Sederhana systems. Assuming there is an interest in encouraging such participation, there are certain relationships that should be kept in mind.

A. Design. Large changes in design of on-farm canals are associated with large changes in the design of on-farm structures ($r=.65$). This is sensible, and implies that changes in designs of on-farm works are done with some deliberation, since the factors that warrant changing on-farm structures also warrant changing on-farm canals. Changes in design of on-farm works are unrelated to the total amount of on-farm works construction that eventually takes place. This means that larger projects are not any more likely than smaller ones to have large design changes. There is a very strong correlation (.89) between design changes in on-farm structures and the number of on-farm structures that the farmers build.

There is no relationship between design changes in on-farm works and total design-to-construction changes in on-farm works. This is puzzling. If farmers are effectively involved in pre-construction design, one would expect that any further changes in the design (during construction) would be relatively small. If something exceptional occurs in a site that has been well-done designed, however, then a further design change would be expected.

In other words, on the one hand, there may be large changes in pre-construction design and very few changes as the design is used during construction. On the other hand, large pre-construction changes may also be followed by large changes in the design as it is implemented. Because of the way the data are distributed, this relation needs more investigation. But it suggests that whatever is acting to change designs before construction starts does not change designs after construction starts.

B. Construction. Two of the variables measure farmer participation in construction. One is the absolute amount of work done by the farmers, whether in meters of canals or numbers of structures built. The second is the percentage of the total work that was done by the farmers. (Some of the work is done by farmers and some by contractors.)

1. The two variables are closely related. In other words, the more on-farm canals or on-farm structures that farmers built, the higher was their percentage of the total amount of work done ($r = .44$).

2. Sites with many farmer-built on-farm structures also had (a) more farmer-built on-farm canals (r = .43), and (b) more farmer-built main system canals (r = .93).

3. Sites that had a higher percentage of on-farm canals built by farmers also had (a) a higher percentage of farmer-built drainage canals (r = .56) and (b) a higher percentage of farmer-built on-farm structures
(r = .43).

11. Conclusions.

A. Government-supported and managed irrigation traditionally has excluded farmers from important decisions and activities in irrigation system development. By contrast, farmers are often involved in many such decisions in "communal" irrigation systems. This paper has described how HPSIS farmers participate in changing irrigation system designs and how they participate in constructing tertiary and quaternary works. HPSIS has successfully involved farmers in these crucial parts of system development in government-managed small systems.

B. As HPSIS has matured, there has been a trend towards more change in the designs. These designs were originally made with very little if any farmer participation. That they were changed with farmer participation means that the farmers' ideas for their systems differed from the plans of MPW and the contractors. The increase in the size of the changes means two things. First the COs and farmers are interacting more effectively than they did when HPSIS began, which means that we are all learning from our experience. Second, MPW is becoming more receptive to the general idea of farmer participation and to the specifics of farmers' suggestions.

C. Total construction of on-farm works is roughly the same at HPSIS sites and Sederhana sites (although the data are incomplete at this time).

D. There was quite a bit of change from the system as designed to the system as constructed. Such change is common in Sederhana sites even without farmer participation. The big difference in the HPSIS sites, however, is that <u>all of this change was negotiated with farmers</u>. MPW's acceptance of a role for farmers in making these changes is a significant departure from the usual ways of doing design.

E. Farmers have participated in constructing significant parts of their irrigation systems at the HPSIS sites. In some cases, the farmers have donated all or part of their labor. The average amount of construction at the HPSIS sites is higher than at the Sederhana sites used for comparison, even though farmer participation at those Sederhana sites is higher than usual since it is supported by Padat Karya.

F. The farmers built a higher percentage of their systems in the HPSIS sites than they did in the Sederhana sites. In the SM sites, with the help of COs, all of the new construction was negotiated between the farmers and MPW and most of the actual work was done by the farmers.

G. One of the propositions that inspired HPSIS is that different kinds of farmer participation are related to each other. In particular, farmer participation in earlier stages of system development are thought to be related to farmer participation in later stages of system development. This proposition is partly testable with the data presented in this paper. If true, high levels of (farmer-inspired) design change should be followed by a high percentage of farmer-constructed works. Looking at on-farm works, the results are mixed. There is a high correlation between design change in on-farm structures and the percentage of those structures built by farmers. But there is no similar correlation between design change in on-farm canals and the percentage of those canals built by farmers.

H. Still unanswered for the moment is the question of how all of the farmer participation affects the quality and performance of the HPSIS systems. Future reports will focus on the answer to that.