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LAND AND WATER RIGHTS AND THE DESIGN OF SMALL-SCALE IRRIGATION PROJECTS:
THE CASE OF BALUCHISTAN

by

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FOREWORD

This report outlines a World Bank-financed project in Baluchistan to rehabilitate or construct some 30 community irrigation systems. The irrigation systems described are managed by the farmers who are served by it; the government is not directly involved in the day-to-day management of such small-scale systems, although the government is very much involved with providing periodic improvements. These "farmer-managed irrigation systems" (FMIS) comprise an important agricultural resource in many developing countries. In some regions, particularly many hilly areas, they comprise the dominant form of irrigation, and offer significant potential for improved agricultural productivity as well as social welfare and equity.

The author of this report, Robert Hecht, is a staff member of the World Bank who was overseeing the Baluchistan project from Washington, visiting periodically on project supervision missions. Thus, the author is a participant, as well as a commentator. This report has been produced by the International Irrigation Management Institute (IIMI) as part of an effort to promote discussion about strategy options for assisting the FMIS sector. Professionals with experience in FMIS assistance projects are best placed to offer suggestions as to what works best under what conditions. We hope to elicit many additional accounts of FMIS assistance projects from various perspectives, including implementing agencies (e.g., irrigation departments, special project authorities, non-governmental organizations), university researchers, private consultants, and representatives from multilateral and bilateral aid agencies.

IIMI serves as the coordinating institution for an international network on FMIS issues which currently links more than 300 irrigation professionals in more than 30 countries, primarily in Asia and Africa. The objectives of the FMIS Network are to 1) enhance the use of existing knowledge through facilitating interaction among researchers, policy makers, and managers around the world and 2) facilitate research on and implementation of innovative approaches to assisting FMIS. The FMIS Newsletter, a quarterly publication, is available upon request. For further information, please contact:

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LAND AND WATER RIGHTS AND THE DESIGN OF SMALL-SCALE IRRIGATION PROJECTS: THE CASE OF BALUCHISTAN

Robert Hecht*

INTRODUCTION

In small-scale irrigation schemes around the world, including the developing countries, farmers have over time evolved complex systems for allocating land and irrigation water. These systems are based upon indigenous principles of natural resource use, and are put into practice through coherent sets of operational rules. Such principles and rules are also related to a series of land and water rights recognized by the community and exercised by the beneficiaries of the irrigation schemes.

Arrangements for land and water allocation are often particularly complex in situations where these production factors are scarce (e.g., in arid zones). Under these circumstances, farmers are acutely interested in any prospective changes either in water and land availability, or in the principles and practices for allocating these resources. Infringement upon existing land and water rights becomes a controversial matter, and often results in political and legal moves to defend these rights, and even in violent physical remedies.

The World Bank, other development agencies, and the developing countries themselves, are involved in rehabilitating or otherwise improving existing irrigation schemes.¹ In these cases, it is essential that planners and project officials understand and take into account the already-existing patterns of land and water rights, and the established procedures for scheme operation. An appreciation of these rights and procedures can, and should, influence many aspects of project design, including 1) layout of the irrigation water distribution network, 2) water management practices (especially scheduling of water issues), 3) anticipated cropping patterns, and 4) estimated incidence of project benefits among scheme participants. The preexisting system of property rights helps to define the physical and socioeconomic limits to change under the project, by bounding the set of socially-acceptable arrangements for layout, water scheduling, etc. The preexisting system is a reality that must be analytically decomposed, if planners are to make accurate predictions of the outcomes of project interventions. That is to say, planners and project officials are not designing the project upon a tabula rasa; on the contrary, their consultations with farmers -- the latter's virtual collaboration in project design -- can only be effective if prevailing property rights and irrigation practices are well understood.

In order to do so, the planners -- including World Bank project officers -- need to apply an appropriate methodology for analyzing these rights and practices, as well as a methodology for continuously involving the farmers in project design and execution. Such a "methodology for social action" (Cerneja 1987) is lacking in most development projects, where researchers have relied

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on making exhortations to increase beneficiary participation, rather than on proposing concrete measures to achieve such participation. The elaboration of such a participatory methodology is a continuous and sometimes long-term process of experimentation, requiring both specific actions (meetings, surveys, training courses, etc.) and institutional support.

THE BALUCHISTAN CASE

The above points can be illustrated with examples from Baluchistan, where since 1983, the World Bank has been supporting a project in that remote and arid western province of Pakistan. Entitled the Baluchistan Minor Irrigation and Agricultural Development Project (BMIAD),² the project's major objective has been to rehabilitate or construct about 30 small-scale gravity flow irrigation schemes scattered throughout the province, covering a total irrigated area of about 9,500 acres. In the case of Baluchistan, small-scale gravity flow schemes incorporate a range of irrigation technologies, including weirs, springs, underground canals (kareze) tapping mountain water, and infiltration "galleries" used to collect subsurface flows in dry riverbeds. These various forms of small-scale irrigation have been in operation in Baluchistan for at least two centuries. Each of these technologies for capturing and conveying water is linked to a modest downstream network of canals and outlets for regulating the distribution of irrigation water to farmers' fields. The average BMIAD scheme was originally envisioned to supply irrigation to about 300 acres, benefitting about 60 farm families.

By the time of project appraisal in June 1981, two schemes, identified by local consultants as possible "model" irrigation schemes, had been investigated. These investigations concentrated heavily upon the hydrology, geology, and agriculture of the prospective schemes, and largely ignored land and water rights and scheme management (operation, water scheduling, repairs, and maintenance). The consultants did not analyze existing property rights and irrigation management practices. Instead, their socioeconomic investigations consisted of reproducing the official population census of the scheme villages, and preparing a table showing the distribution of land holdings by size, based on existing cadastral records. Furthermore, the planners and project officials did not consult systematically with farmers in the scheme area concerning various design options for physical rehabilitation, the construction program (including villagers' labor contribution, as envisioned at appraisal), or future operation and maintenance (O&M) of the rehabilitated schemes. Contacts between the outside planners and the beneficiaries of rehabilitation were limited to a single perfunctory meeting with the villagers to sign a water users association agreement, and a few sporadic and ad hoc discussions between individual farmers and the engineering consultants during their site investigations.

This approach to scheme selection and design, emphasizing the engineering and agricultural dimensions of the minor irrigation schemes while down playing socioeconomic analysis and beneficiary participation, persisted through appraisal and the early years of project implementation in 1983-1985.

During this period, an Area Planning and Development Team (APDT) attached to the project office identified an additional 8-10 schemes, and private local consultants then studied these schemes to feasibility grade. The APDT, which included an officer designated specifically to ensure local participation, limited its actions to signing the water users association agreements. The local consultants did not employ staff to analyze socioeconomic variables related to scheme design, nor did they apply procedures for consulting farmers on current or planned irrigation investments. Following completion of these feasibility reports and detailed engineering design, contractors were engaged for civil works construction of five schemes.

By mid-1985, it was becoming apparent that weak socioeconomic analysis during scheme investigation and planning, plus minimal consultation with benefitting farmers, were resulting in a series of implementation problems:

- * Disputes over land acquisition for canal construction. In one scheme, a land-owning family blocked construction by refusing to allow an important bifurcation structure to be built on their land, because water flowing through one side of the structure was to be allocated to a rival clan.
- * Disagreements over the appropriate capacity and layout of canals, and the location of farm outlets. In one case, landowners on the left bank of a stream insisted that their supply canal should have a four cusec (cubic feet per second) capacity, rather than the two cusec capacity designed by the engineers, simply to achieve parity with landowners on the right bank. In another case, farmers halted the lining of a canal, arguing that it should be located in a different area where new land could be brought under irrigation and water would be more accessible for domestic use. In a third instance, farmers smashed the outlets built by the contractor according to engineer's drawings, complaining that the new outlets prevented them from distributing water according to their traditional system of water shares.
- * Protest from farmers who feared they would be denied their "rightful" shares of irrigation water. In one dramatic case, clan members threatened a contractor and burned his camp, to express their anger over a proposed scheme design which they felt would deprive them of a portion of the irrigation water.

In addition, project officials and donor representatives became increasingly concerned about the equitable distribution of irrigation benefits among the farmers, since land and water rights had not been clearly established at the planning stage. It was feared that in one or two schemes, a large-scale landowner might reap most of the incremental irrigation benefits. The donors were also concerned that beneficiaries might not understand or accept their obligations to operate and maintain the rehabilitated schemes, without recourse to government assistance, as agreed with the government at appraisal. The above-mentioned opposition to the proposed schemes from the farmers, plus the donors' doubts about the viability and equity of scheme design, contributed to major delays in project implementation.³

Confronted with these implementation problems arising from incomplete socioeconomic analysis and farmer consultation, project officials, supported by technical assistance and the Bank, began to develop new approaches to scheme selection and design. During 1985, an expatriate consultant, assisted by the economics and local participation officers of the APDT, designed and tested a socioeconomic survey questionnaire which focused on property rights and irrigation practices. The APDT modified the water users association agreements to include annexes which spelled out farmers' water shares and specified O&M responsibilities. The APDT also decided to meet regularly with the farmers in order to incorporate their suggestions for scheme design and operation. By early 1986, a fairly specific and concrete methodology had been worked out (Table 1). While by no means a final, fully-refined approach to the problem, this methodology provided an initial framework for analyzing socioeconomic issues -- particularly connected with land and water rights -- and consulting farmers continuously during the various stages of scheme identification, prefeasibility and feasibility study, detailed engineering design, and construction.

At prefeasibility stage, for example, project officials would draw upon existing census, cadastral and water-rights records to assess 1) the number of beneficiaries, 2) the degree of prospective equity in scheme development, and 3) the scope for modifying land ownership, water rights, and operating procedures in order to make the scheme more efficient and productive. With this information in hand, project officials would then consult with the farmers concerning the most acceptable engineering design, O&M practices, and farming system (choice of crops, inputs, and technologies).

At feasibility stage, the local consultants engaged by the project would, in tandem with their other field investigations,⁴ survey the beneficiaries to collect and analyze current data on land and water rights, land tenure (including tenancy), cultivation practices, and operational arrangements. These survey results would then be reconciled with the prefeasibility data gleaned from government records, and, in combination with the physical survey data, would be used to prepare an engineering and institutional design for the scheme.⁵ The methodology outlined in Table 1 was also expected to produce specific outputs, including chapters in the prefeasibility and feasibility reports and preliminary and final scheme agreements with the water users associations.

In order to apply effectively the proposed socioeconomic methodology, it was agreed that certain staffing changes would be required at three levels. First, the project office would engage one senior social researcher on a contract basis, plus three junior officers capable of collecting land and water rights data and facilitating consultation between farmers and planners. Second, the local consultants, who were heavily oriented toward engineering, would also employ economists and sociologists for surveys and data analysis at feasibility stage. Third, the expatriate technical assistance team attached to the project office was asked to hire a local sociologist for review of scheme design reports, and subsequently, to employ a foreign sociologist with expertise in property rights issues, to refine the proposed analysis/consultation methodology and train the local social science personnel in its application.

By early 1987, the results of using the new socioeconomic methodology were already becoming visible. No new land and water disputes arose in 1986, and construction was restarted at three suspended sites. Three more schemes were readied for construction, on the basis of clearer definition of water rights and operational responsibilities. Moreover, project officials indicated that they were gaining a deeper appreciation of the importance of socioeconomic factors (especially tribal structure, land ownership, and water-rights shares) in Baluchistan irrigation scheme design, and were going to make a new and concerted effort to resolve tribal disputes and enlist greater participation by the villagers in scheme planning and construction. The full socioeconomic methodology was to be applied to all new schemes developed in 1987. In order to illustrate its value for effective scheme planning, two examples are cited below.

Chashma Achozai

A small village located only about 10 miles from Quetta, the provincial capital of Baluchistan, Chashma Achozai was studied in 1985-1986 by the APDT and an expatriate economist, in connection with possible upgrading of its main supply canal and improved cultivation practices for irrigated vegetables and fruit trees. Their socioeconomic survey revealed the following information (Table 2):

- * In total, there were 25 farm "households" comprising 453 persons from 3 ethnic Pathan tribes (Kaker, Kasi, Domer). Many of these households (average size of 18 persons) consisted of several conjugal families related through a common male ancestor. For purposes of agricultural decision making (water and land allocation, choice of crops, etc.), these kin groups acted as a single unit.
- * The 25 households owned a total of 1,035 acres of arable land, of which 232 acres (22%) were irrigated from a mountain spring (Chashma) and 48 acres were irrigated from privately held tube wells. While total landholdings varied widely among tribes and among households within the tribe, irrigated farmland was fairly equally distributed. The lowest 30 percent of households owned about 17 percent of the irrigated land, while the upper 20 percent owned about 40 percent of the spring-fed area.
- * Each household had inherited from its antecedents a clearly-defined share of the spring water, as measured in hours of access to the full canal supply. Within each of the three tribes, the ratio of water rights to total landholdings was fairly uniform (one hour for 2.3 acres among the Kaker tribe, 2.9 acres for the Kasi, and 3.8 acres for the Domer), suggesting that land and water rights were generally allocated in fixed and consistent proportions among tribesmen.⁶ Furthermore, 60 percent of all farm households irrigated 0.5-1.0 acre of land per hour (ac/hr) of allocated water, with an overall standard deviation of only 0.4 ac/hr.
- * Spring water for irrigation was allocated to households according to a fixed schedule of turns, on a 14-day (336 hour) cycle. During his turn,

each farmer was responsible for regulating the flow of water to his farm plots, which were generally scattered among various locations within the irrigated area. There was a high degree of fragmentation of irrigated holdings, with an average of 7.5 plots per household.

- * Scheme O&M decisions were traditionally taken by representatives of the 25 farm households, without government involvement. Each farmer was responsible for building and maintaining his own on-farm works and outlets to his fields. Main canal maintenance and repairs were carried out collectively, with households contributing labor, materials, and cash in proportion to their water shares. Where collective works were required, the 25 household representatives would meet and work out details on the basis of full consensus.

The above information (which was related to cadastral survey data), irrigation service area, and topographical maps, suggested to project and Bank officials the following lessons for designing scheme improvements:

- * Any additional irrigation water made available through improvements to the canal system and reduced irrigation conveyance losses would almost certainly be divided among the current water-rights holders, according to their current shares. As stated in the report analyzing the survey data:

"It was also made clear (by the farmers) that additional water made available for the irrigation system would be shared on a pro-rata basis according to existing shares. Any attempt to increase the number of beneficiaries would meet with strong resistance, and if such a suggestion were to be implemented, long negotiation would be required."
- * Given the existing high degree of fragmentation of landholdings, it would be desirable to consolidate these holdings in order to promote improved agricultural practices (especially tractor plowing) and increase irrigation efficiencies. Furthermore, it would be desirable to reschedule the sequence of irrigation turns, in order to supply water from one adjacent landholder to another, thus reducing delays and conveyance losses. While both of these changes appeared to be feasible and acceptable to most farmers, they would need to be discussed and ratified by all 25 members of the irrigation scheme.
- * If incremental irrigation water were effectively provided through rehabilitation, scheme farmers would possess sufficient additional land to expand their areas under irrigation, either to grow crops with low (wheat, barley) or medium (vegetables, orchards) intensities of water use. Because Chashma Achozai is located near the city of Quetta, scheme farmers would have ready access to markets for the full range of such crops.
- * Depending on the agreed configuration of landholdings and schedule for water distribution, the exact size and location of irrigation control

structures and outlets would need to be decided following consultation with individual farmers. Land consolidation could potentially reduce the number and cost of these outlets. In keeping with existing practice, there appeared to be some precedent for requesting the beneficiaries to pay for their own outlets. Furthermore, based on current procedures for O&M, farmers seemed to be prepared to contribute collectively at least a part of the cost of channel improvements (concrete lining and control structures), in proportion to their respective water shares.

- * Any benefits derived from improvements to the scheme would be distributed among the 25 members, in relation to their existing water shares. Because these shares were roughly equal, scheme rehabilitation would not be likely to create or exacerbate inequalities at Chashma Achozai.

Sorh

The unirrigated community of Sorh, is located in the southern part of Baluchistan about 95 miles (about 153 kilometers) north of Karachi on poorly-maintained gravel roads. The village was studied at prefeasibility stage by project staff and expatriate consultants in mid-1986 to assess the feasibility of providing irrigation water by pumping directly from the nearby Hub River, to allow cultivation of high-value horticultural crops (fruits and vegetables). Based on the socioeconomic data collected, the following observations were made:

- * A single Baluch tribe, the Bhotani, was settled in the proposed scheme area. In the two most promising zones for pump irrigation as identified by project officials, the land ownership pattern was already established in some detail, but exhibited certain rather ambiguous features. Prior to 1967, it appeared that the entire 726 acres came under the control of the tribal leader (sardar), who supervised about 40 lower-status tribesmen working as his sharecroppers. Following land reform in 1967, these tribesmen received title to one-half of the area they had previously sharecropped, while the other half was assigned to the sardar's heirs as a common property. The sardar's eldest son also obtained individual title to another large portion of this land, while the remainder (generally rocky areas considered less fertile and unsuitable for rain-fed cultivation) was classified as public land, belonging to the Baluchistan Government.
- * While certain features of the land tenure system remained ambiguous, socioeconomic analysis revealed that the current distribution of holdings was unequal (Table 3). Leaving aside 230 acres of government land and concentrating on the remaining 496 acres in the scheme area, the 16 living heirs to the previous sardar jointly owned 171 acres (35%); the current sardar held 99 acres (20%); while the 41 former sharecropping tribesmen had title to 225 acres (45%). If the 171 acres of joint property were excluded, and only the 324 acres owned individually were analyzed (Table 4), the resulting distribution was highly skewed. The lowest 30 percent of households owned just 6 percent

of the land, while the upper 10 percent (the sardar and three other farmers) owned 50 percent of the scheme area. Fourteen farmers had microholdings of less than three acres. If, for purposes of analysis, the 16 joint owners were considered to have equal shares in the previous sardar's patrimony, the distribution effects improved only slightly. Under these circumstances, the community could be seen as split between the rich landlords (85% of the land) and the poor tenant-owners (15% of the land). In any case, the current sardar, with 99 acres, was the dominant landowner in the area.

- * The nonpartible inheritance of 171 acres, plus the 99 acres belonging to the current sardar, were cultivated by other tribesmen on a sharecropping basis, using rain-fed (barani) techniques. Under these sharecropping arrangements, the owner provided all inputs and received one-half of the crop, with the remaining half of the harvest belonging to the tenant. The other 41 individual holdings were generally owner-operated.
- * Fragmentation of landholdings appeared to be a serious problem. Most farmers had 2 or more plots, and 10 of the 41 small holders had an average plot size of less than 1 acre. In one extreme case, a particular farmer owned 3.8 acres scattered among 11 plots, while another had 1.91 acres divided among 3 plots.
- * As there was no existing irrigation in the area, water rights had not been established. However, the farmers surveyed, in expressing to project officials their strong desire to construct a pump system, also agreed that any future irrigation water should be shared among farmers in proportion to the amount of their land brought under irrigation.

Based on the above socioeconomic analysis the following suggestions were made by the World Bank project staff, as being consistent with the existing social structure and pattern of property rights:

- * The irrigation scheme layout should be designed to achieve a more equitable distribution of benefits, by favoring the small-scale landowners, and, to the extent feasible, by alienating to these poor farmers irrigable plots currently classified as government land. Otherwise, if the layout were to be purely neutral with respect to benefit distribution, the few large-scale landowners would certainly gain the lion's share of the irrigation water and related agricultural benefits. However, given the dominance of the sardar in Baluch society, and his importance in mobilizing the local farmers and organizing them to operate and maintain the proposed scheme, project officials should by no means ignore or snub the sardar and the other major landowners. The proposed irrigation layout should be closely reviewed and ratified by all the farmers, with the sardar's strong backing.
- * Given the high degree of fragmentation of landholdings in the scheme area at present, planners should explore the feasibility of land consolidation, in order to facilitate farm management, promote improved agricultural practices, and increase irrigation efficiencies. With the

aid of maps, cadastral records, and site surveys, project officials should collaborate closely with the farmers in such a consolidation exercise.

- * Assuming that the irrigation service area can be defined in a reasonably equitable manner, the farmers appear to be quite amenable to the principle of allocating individual water-shares in proportion to the size of irrigable holdings. Moreover, depending on the boundaries of individual holdings and the results of land consolidation, the farmers would also seem to be prepared to accept a hydraulically efficient layout, with a rectilinear configuration and fairly uniform blocks of irrigable land. This would also have to be explained to, and approved by, the farmers.
- * Since the Sorh scheme would be a new irrigation system, it presents to the planners and farmers an opportunity to devise a simple, workable rotational water delivery schedule. Accordingly, in the prefeasibility report, a 10 day rotation was proposed for further study, consisting of an 18 hour pumping day with farmers expected to take water by turns. Irrigation blocks would be laid out on an appropriate scale to receive adequate water for one pumping-day. The details of this layout and schedule would need to be confirmed by the farmers, and would have to be consistent with the actual pattern of land ownership observed on the ground.
- * The farmers already agreed in principle to pay the full cost of pump O&M, and to contribute these funds in relation to their assigned share of irrigation water. However, the details of scheme operation would need to be formulated and accepted by the farmers, covering the exact scales and timing of payments, and the arrangements for hiring pump operators and procuring fuel, lubricants, and spare parts. Given the ethnically homogeneous nature of the local population and their common allegiance to the sardar, project officials should explore the possibility of fostering a single cohesive irrigators' association to manage the proposed scheme.

CONCLUSION

The above case studies demonstrate the importance of socioeconomic analysis, and especially the study of land and water rights, in the planning and implementation of irrigation projects. Improved irrigation schemes must be designed in relation to existing rights and practices; these can only be ignored at the peril of developing country governments and aid agencies, as the Baluchistan case has shown. To do so is equivalent to a doctor treating a patient without knowing his medical history or daily work, diet, and exercise habits.

The Baluchistan case also demonstrates how vital it is to involve the scheme farmers in diagnosing their own irrigation problems, and in proposing, refining, and implementing the appropriate solutions. As the BMIAD examples illustrate, such socioeconomic analysis and beneficiary consultation can be

undertaken by project officials in a timely and efficient manner, provided that they focus on the essential analytical issues, apply a coherent methodology, and engage professional staff with adequate social research skills to organize and execute these tasks.

To be effective, the socioeconomic methodology employed must be action-oriented, and not simply a passive observation of the status quo. That is to say, the variables analyzed (in this case, mainly property rights and institutions for irrigation management) must be relevant in predicting the actual outcomes of project interventions, and amenable to change as part of the project's social design. Application of the socioeconomic methodology should lead to specific predictions of project outcomes under different scenarios (e.g., land consolidation, reallocation of water rights, various engineering solutions for irrigation supply), and to equally specific recommendations for optimal project intervention. Moreover, the socioeconomic methodology should comprise a series of action measures to elicit beneficiary resources (knowledge and ideas, institutions, labor, and money) that would improve project design and enhance the actual results of implementation. While such a methodology can be mapped out in broad outline at project inception, it needs to be continuously refined during the implementation of the project.

NOTES

1. In Sri Lanka, for example, the World Bank is supporting the Village Irrigation Rehabilitation Project, Cr. 1160-CE, US\$30 million. In the Philippines, the Bank is financing the Communal Irrigation Development Project, Ln. 2173-PH, US\$71.1 million. In Malaysia, it helped to finance the National Small-Scale Irrigation Project, Ln. 1444-MA, US\$39 million.
2. IDA Credit 1243-PAK, SDR 12.5 million.
3. The delays in 1983-1985 can also be partly attributed to other factors, including poor performance by several local contractors, inadequate construction supervision by project officials, and tribal disputes not directly linked to the proposed scheme design.
4. Hydrological, geophysical, and soils investigations.
5. In this context, engineering design is meant to cover physical structures (headworks and downstream works) and proposed irrigated area, while institutional design includes proposed O&M procedures, land and water rights, organization of irrigators, and the related regulations and conventions governing the above.
6. Even for the scheme as a whole, the standard deviation (0.9 ac/hr) was only about one-third of the mean value (2.8 ac/hr).

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Table 11. Socio-Economic Methodology

Stage of Scheme Preparation	Objectives	Activities		Outputs
		Data Collection/ Analysis	Beneficiary Consultation	
1. <u>Identification</u>	<ul style="list-style-type: none"> - Assess farmer interest in prospective scheme. - Highlight obvious and severe social conflicts. 	<ul style="list-style-type: none"> - - 	<ul style="list-style-type: none"> - Brief reconnaissance, to measure degree of farmer interest and detect obvious conflicts/problems (feud, court cases, hostility toward GOB). 	<ul style="list-style-type: none"> - Reconnaissance report screening.
2. <u>Pre-feasibility</u>	<ul style="list-style-type: none"> - Determine existing property rights, operational practices, institutional arrangements, in order to estimate impact (agricultural, financial, benefit incidence) of possible project actions. - Ascertain degree of farmer acceptance of basic design concept; refine design based on farmer concerns, observations, suggestions. 	<ul style="list-style-type: none"> - Population data from census. - Landholdings and tenurial maps from cadastral registers. - Water rights lists. - Basic tribal/social organization of scheme farmers. 	<ul style="list-style-type: none"> - Discussions with farmers on engineering concept (e.g., gallery/weir, bifurcations/aqueducts, channel alignment, type of outlets) and operational plans - Re-evaluation of any emerging social conflicts. 	<ul style="list-style-type: none"> - Chapter in Pre-feasibility report. - Charter of Water Users Association (WUA). - Preliminary scheme agreement.
3. <u>Feasibility</u>	<ul style="list-style-type: none"> - Define water rights and water distribution schedule, prospective command area and landholdings, in relation to agreed water shares. - Establish realistic rules for operation & maintenance (O&M). - Ensure that proposed cropping pattern, farm technology, and yields are achievable. 	<ul style="list-style-type: none"> - Well-focused field survey of farmers to collect current data on land and water rights, land tenure, irrigation practices, agricultural and marketing activities. 	<ul style="list-style-type: none"> - Discussions and preliminary decision on scheme engineering design. - Clear agreement from farmers on water-shares, O&M, beneficiary contribution to scheme construction (labor, materials, cash). 	<ul style="list-style-type: none"> - Various chapters in feasibility report. - Final scheme agreement with WUA.
4. <u>Detailed Engineering Design</u>	<ul style="list-style-type: none"> - Ensure that detailed design, especially type and location of downstream structures (outlets, drops, channel lining) is acceptable to farmers. 	<ul style="list-style-type: none"> - 	<ul style="list-style-type: none"> - Discussions between engineers and beneficiaries, assisted by social researchers, on type and location of structures. 	<ul style="list-style-type: none"> - Appropriate changes (technically, economically, socially feasible) in detailed design report.
5. <u>Construction</u>	<ul style="list-style-type: none"> - Ensure that detailed design as contained in tender documents/contracts is still acceptable and meets operational needs of farmers. 	<ul style="list-style-type: none"> - 	<ul style="list-style-type: none"> - Supervising engineers, contractor, and project staff to consult farmers as construction proceeds, acting expeditiously and flexibly to make minor design changes, within reasonable cost limits. 	<ul style="list-style-type: none"> - Minor modifications to downstream and CAD works, as required.

TABLE 2
CHASMA ACHOZAI:
IRRIGATION LAND AND WATER RIGHTS

FARMER	TOTAL LAND OWNED (AC) (1)	SPRING-FED LAND (AC) (2)	SPRING WATER RIGHTS (HRS) (3)	TOTAL LAND-TO- WATER RIGHTS RATIO (AC/HR)	IRRIGATED LAND- TO-WATER RIGHTS RATIO (AC/HR)
ZUL KAKER	24.0	10.0	9.0	2.7	1.1
HUR KAKER	20.0	6.0	8.0	2.5	0.8
HAA KAKER	18.0	11.0	8.5	2.1	0.8
SU KAKER	18.0	7.0	8.5	2.1	0.8
AJ + AQ KAKER	40.0	9.0	16.0	2.5	0.6
SK KAKER	25.0	6.0	12.0	2.1	0.5
KED KAKER	4.0	4.0	3.0	1.3	1.3
TRIBAL SUBTOTAL	149.0	53.0	65.0	2.3	0.8
MI + SA KASI	50.0	7.5	20.0	2.5	0.4
AU KASI	50.0	12.0	20.0	2.5	0.6
AA KASI	25.0	9.0	10.0	2.5	0.9
AH KASI	25.0	10.0	10.0	2.5	1.0
MN KASI	155.0	19.5	36.0	4.3	0.5
N KASI	16.0	5.0	12.0	1.3	0.4
AR KASI	65.0	18.0	28.0	2.3	0.6
KER KASI	35.0	5.0	12.0	2.9	0.4
TRIBAL SUBTOTAL	421.0	86.0	148.0	2.8	0.6
UU DOMER	42.0	16.0	9.0	4.7	1.8
AH DOMER	84.0	17.0	18.0	4.7	0.9
H DOMER	174.0	23.0	37.5	4.6	0.6
AR DOMER	40.0	10.0	12.0	3.3	0.8
KU DOMER	20.0	4.0	6.0	3.3	0.7
AR DOMER	20.0	7.0	6.0	3.3	1.2
N MOHAMED	20.0	?	6.0	3.3	?
AS DOMER	20.0	6.0	6.0	3.3	1.0
PK DOMER	30.0	6.0	12.0	2.5	0.5
GR DOMER	15.0	4.0	10.5	1.4	0.4
TRIBAL SUBTOTAL	465.0	93.0	123.0	3.8	0.8
SCHEME TOTAL	1035.0	232.0	336.0	3.1	0.7

TABLE 3
SORH: PRIVATE LAND OWNERSHIP

FARMER	LANDHOLDING (AC)	NUMBER OF PARCELS	AVG PARCEL SIZE (AC)	HOLDING AS % OF AREA
ABU BAKAR	4.22	3	1.41	0.85
ISMAIL + BROS	2.49	1	2.49	0.50
SULEIMAN	1.97	1	1.97	0.40
USMAN	0.61	2	0.31	0.12
JARIO	0.86	2	0.43	0.17
KHUDA BAKHSH	2.25	3	0.75	0.45
YACOOB	12.43	6	2.07	2.51
MUBARAK	6.42	2	3.21	1.30
ISMAIL S/O DUR	4.40	2	2.20	0.89
MANDU	0.61	1	0.61	0.12
HAMZA	3.17	3	1.06	0.64
ESSA	2.38	2	1.19	0.48
M SIDDIQ	3.75	11	0.34	0.76
DOST MOHAMMAD	0.14	1	0.14	0.03
AHMED S/O ADAM	19.46	4	4.87	3.93
UMER S/O ULLOO	1.81	1	1.81	0.37
MAZAR	5.34	3	1.78	1.08
CHAKLOO	4.07	2	2.04	0.82
ALI BAKHSH	8.15	4	2.04	1.64
SHAFO	3.04	1	3.04	0.61
LADAO	3.26	3	1.09	0.66
GHULAM M	6.23	4	1.56	1.26
IBRAHIM	4.89	1	4.89	0.99
SHERO	2.87	3	0.96	0.58
ROZI	1.91	3	0.64	0.39
BAHARIO	1.99	1	1.99	0.40
WARIO	4.98	1	4.98	1.00
MUSA	0.67	1	0.67	0.14
EIDO	0.31	1	0.31	0.06
MOHAMMAD MURAD	5.98	4	1.50	1.21
ALI AHMED	7.67	3	2.56	1.55
JAFAR	4.64	2	2.32	0.94
ISMAIL	6.69	2	3.35	1.35
AZEEM	9.80	4	2.45	1.98
JANOO	9.69	1	9.69	1.95
UMER	34.98	6	5.83	7.06
BHAI KHAN	4.82	1	4.82	0.97
MOHAMMAD ALI	4.32	1	4.32	0.87
GHULAM MUSTAFA	9.60	2	4.80	1.94
AHMED	3.89	1	3.89	0.78
AMIR BAKHSH	8.64	1	8.64	1.74
SUBTOTAL	225.40	101	2.23	45.47
SARDAR-SELF	99.23	12	8.27	20.02
SARDAR-16 HEIRS	171.07	92	1.86	34.51
TOTAL	495.70	205	2.42	100.00

TABLE 4
SORH: LAND DISTRIBUTION

A: EXCLUDING SARDAR'S JOINT INHERITANCE

INTERVAL (ACRES)	NUMBER OF FARMS	PERCENT OF FARMS (%)	AREA (ACRES)	PERCENT OF AREA (%)
0 - 1	6	14.3	3.2	1.0
1 - 3	8	19.0	17.7	5.4
3 - 5	13	31.0	53.5	16.5
5 -10	11	26.2	84.2	25.9
10-20	2	4.8	31.9	9.8
> 20	2	4.8	134.2	41.3
TOTAL	42	100.0	324.6	100.0

B. INCLUDING JOINT INHERITANCE

INTERVAL (ACRES)	NUMBER OF FARMS	PERCENT OF FARMS (%)	AREA (ACRES)	PERCENT OF AREA (%)
0 - 1	6	10.3	3.2	0.6
1 - 3	8	13.8	17.7	3.6
3 - 5	13	22.4	53.5	10.8
5 -10	11	19.0	84.2	17.0
10-20	18	31.0	203.0	40.9
> 20	2	3.4	134.2	27.1
TOTAL	58	100.0	495.8	100.0