VILLAGE ORGANIZATIONAL FACTORS AFFECTING WATER MANAGEMENT DECISION-MAKING AMONG PUNJABI FARMERS

Water Management Technical Report No. 35

Prepared under support of
United States Agency for International Development
Contract AID/csd-2162
All reported opinions, conclusions or
recommendations are those of the
authors and not those of the funding
agency or the United States Government.

Prepared by

Ashfaq H. Mirza
David M. Freeman
Jerry B. Eckert

Engineering Research Center
Colorado State University
Fort Collins, Colorado

March 1975

WATER MANAGEMENT TECHNICAL REPORTS*

Council of U.S. Universities for Soil and
Water Development in Arid and Sub-humid Areas

Colorado State University

March 1975

No.	Title	Author	No. of Pages	Cost
1	Bibliography with Annotations on Water Diversion, Conveyance, and Application for Irrigation and Drainage, CER69-70KM3, Sept.'69	K. Mahmood A.G. Mercer E.V. Richardson	165	$3.00
2	Organization of Water Management for Agricultural Production in West Pakistan (a Progress Report) ID70-71-1, May 1970	P.O. Foss J.A. Straayer R. Dildine A. Dwyer R. Schmidt	148	$3.00
3	Dye Dilution Method of Discharge Measurement, CER70-71 WSL-EVR47, January 1971	W.S. Liang E.V. Richardson	36	$3.00
4	Not available			
5	The Economics of Water Use, An Inquiry into the Economic Behavior of Farmers in West Pakistan, MISC-D-70-71DW44, March, 1971	Debebe Worku	176	$3.00
6	Pakistan Government and Administration: A Comprehensive Bibliography, ID70-71GNJ17, March 1971	Garth N. Jones	114	$3.00
7	The Effect of Data Limitations on the Application of Systems Analysis to Water Resources Planning in Developing Countries, CED70-71LG35, May 1971	Luis E. Garcia-Martinez	225	$3.00

*Reports are available from Mrs. Arlene Nelson, Engineering Research Center, Colorado State University, Fort Collins, Colorado 80523. Price: $3.00 each until printing is exhausted; subsequent xerox copies obtainable at ten cents per page.

No.	Title	Author	No. of Pages	Cost
8	The Problem of Under-Irrigation in West Pakistan: Research Studies and Needs, ID 70-71GNJ-RLA19	G.N. Jones R.L. Anderson	53	$3.00
9	Check-Drop-Energy Dissipator Structures in Irrigation Systems, AER 70-71, GVS-VTS-WRW4, May 1971	G.V. Skogerboe V.T. Somoray W.R. Walker	180	$3.00
10	Maximum Water Delivery in Irrigation	J.H. Duke, Jr.	213	$3.00
11	Flow in Sand-Bed Channels	K. Mahmood	292	$3.00
12	Effect of Settlement on Flume Ratings	T.Y. Wu	98	$3.00
13	The Problem of Water Scheduling in West Pakistan: Research Studies and Needs, ID 71-72GNJ8, November 1971	G.N. Jones	39	$3.00
14	Monastery Model of Development: Towards a Strategy of Large Scale Planned Change, ID 71-72GNJ9, November 1971	G.N. Jones	77	$3.00
15	Width Constrictions in Open Channels	J.W. Hugh Barrett	106	$3.00
16	Cutthroat Flume Discharge Relations	Ray S. Bennett	133	$3.00
17	Culverts as Flow Measuring Devices	Va-son Boonkird	104	$3.00
18	Salt Water Coning Beneath Fresh Water Wells	Brij Mohan Sahni	168	$3.00
19	Installation and Field Use of Cutthroat Flumes for Water Management	G.V. Skogerboe Ray S. Bennett Wynn R. Walker	131	$3.00

No.	Title	Author	No. of Pages	Cost
20	Steady and Unsteady Flow of Fresh Water in Saline Aquifers	D.B. McWhorter	51	$3.00
21	Dualism in Mexican Agricultural Development: Irrigation Development and the Puebla Project	H.H. Biggs	28	$3.00
22	The Puebla Project: Progress and Problems	H.H. Biggs	23	$3.00
23	Pakistan Government and Administration: A Comprehensive Bibliography, Volume No. 3	G.N. Jones	259	$3.00
24	Index for the Eight Near East-South Asia Irrigation Practices Seminars	W.L. Neal C. Stockmyer	58	$3.00
25	A Bibliography and Literature Review of Groundwater Geology Studies in the Indus River Basin	Alfred J. Tamburi	33	$3.00
26	Planning Sediment Distribution in Surface Irrigation Systems	Khalid Mahmood	67	$3.00
27	Practical Skimming Well Design	F.A. Zuberi D.B. McWhorter	61	$3.00
28	Physical, Salinity, and Fertility Analyses of Selected Pakistan Soils	W.T. Franklin W.R. Schmehl	29	$3.00
29	Program for Computing Equilibrium Solution Composition in $CaCO_3$ and $CaSO_4$ Systems from Irrigation Water Compositions	Dhanpat Rai W.T. Franklin	42	$3.00
30	Conjunctive Use of Indus Basin Waters-Pakistan: A General Summary of Ph.D. Dissertation	M.T. Chaudhry	37	$3.00
31	Informational Sources on Water Management for Agricultural Production in Pakistan With Special Reference to Institutional and Human Factors, Volume I Volume II	G.N. Jones A.R. Rizwani M.B. Malik R.F. Schmidt	170 251	$3.00

No.	Title	Author	No. of Pages	Cost
32	Crop Water Use and Yield Models With Limited Soil Water	H. M. Neghassi	119	$3.00
33	Design of Irrigation Drop Structures	Soon-kuk Kwun	123	3.00
34	A Study of Village Organizational Factors Affecting Water Management Decision Making in Pakistan	A. H. Mirza	129	3.00

VILLAGE ORGANIZATIONAL FACTORS AFFECTING WATER MANAGEMENT DECISION-MAKING AMONG PUNJABI FARMERS*

The Problem

The farmers of Pakistan are served by the world's largest irrigation system. About forty thousand miles of canals deliver water to approximately twenty-five million acres. The overall pattern of water flow is from one of the major rivers--Jhelum, Chenab, Ravi, Sutlej or Indus--to major and minor canals, through outlets (moghas) to watercourses (khals) to farmers' fields. Information is available about its history, its hydraulic features, and its physical structures (Lieftinck, et. al. 1968, Sir Alexander Gibb, 1966). Unfortunately, there has been little systematic empirical research conducted on that crucial portion of the irrigation system which is operated and managed by the farmer--the watercourse from the canal outlet (mogha) to the field.

The network of canals, in Punjab, is under the control of the provincial department of irrigation. This department is responsible for maintenance of canals, their major and minor branches, throughout the province. Each village has one or more outlets or moghas. Irrigation officials prescribe the size of, and construct each mogha. Furthermore, the government provides a space, sixteen feet in width, for the watercourse to run from the mogha. Because of small holdings,

*The research reported here was conducted as a project under Contract AID/csd-2162, as "Water Management Research in Arid and Subhumid Lands of the Less Developed Countries," between Colorado State University and the United States Agency for International Development.

the irrigation department cannot shorten the length of watercourses. It is the farmers' business to construct a watercourse from the mogha to their fields through prescribed routes for water distribution. Within these constraints, farmers are supposed to make collective decisions to achieve optimum use of irrigation water. In effect, the watercourse is the community property of the farmers served by it; they must organize to provide for watercourse cleaning, maintenance, and for the application of water to their fields.

It is the purpose of this statement to report on research conducted in 1973 on the water management decision making patterns of selected farmers in a sample of fifteen Punjabi villages. The research focused on three aspects of farmer decision-making;

1) Cleaning and Maintenance of Watercourses;

2) Changing of Warabundi;

3) Interaction with Irrigation Authorities.

Cleaning and Maintenance of Watercourses

The quality of watercourses differs from village to village and loss of water is borne by the farmers accordingly. Watercourse cleaning involves collective decisions on the part of all farmers taking water from a given channel. Village farmers understand that there is significant water loss in poorly maintained watercourses, but they differentially mobilize themselves to cope with the problem. Therefore, the first focus of this study is to examine the social influences which operate on the collective decisions to clean and maintain watercourses.

Change of Warabundi

Canal water is divided among farmers on a watercourse according to the acreage of each. Generally, a cultivator has a weekly turn expressed in hours and minutes. There are two primary ways of allocating turns to farmers during each irrigation period:

1) The kacha warabundi system (warabundi is an Urdu word meaning agreement about the water schedule)--a system of rotation arranged by the cultivators themselves. This system of distribution is highly flexible, for it can be changed according to individual farmers' needs and the availability of water. Small farmers, in this system of allocation, are vulnerable to manipulations on the part of more powerful larger farmers.

2) The pacca warabundi system--each turn is fixed for every farmer by the Department of Irrigation. This system possesses the advantage of protecting each farmer's right to the water but flexibility of water allocation is lost as water trading becomes illegal.

The second focus of this study, therefore, is to examine the farmer's decision to switch from kacha to pacca warabundi.

Interaction with Irrigation Authorities

Village farmers are highly interdependent with officials of the Irrigation Department. In particular, there are three lower level officials who are in contact with farmers--Patwaris who assess crop revenue, Overseers who repair and

allocate moghas, and Pansals Nawees who send daily reports about the flow of water in major and minor canals. Where there are public tubewells, there is a fourth official, the Tubewell Operator. These officials have nothing to do with cleaning watercourses or implementation of warabundi system. Nevertheless, they can provide favors or create problems for village farmers. The third focus of this study is on the interaction between village farmers and these irrigation authorities.

Significance of the Problem

Approximately 80 million acre feet of water are annually conducted through the canal system to serve about twenty-five million acres of land. Corey and Clyma (1973:10) report an estimate that only about fifty-two million acre feet reach the farmers' fields due to transit loss--a fact which means only about 2.1 acre feet per acre are potentially available for agricultural production as compared to over 10 acre feet per acre which is routinely diverted into the Imperial Valley of California each year. The Pakistani farmer operates under virtual drought conditions. Yet, the productivity of improved seeds and fertilizers which have constituted much of the "green revolution" is centrally dependent upon adequate supplies of irrigation water. Reidinger (1974) notes that farmers find that lack of sufficient water and the inappropriate timing of water deliveries, severely limit their ability to realize the promise of improved seeds and fertilizers. Given an inadequate supply of water, the

farmer must reduce the level of all of his "modern," and relatively costly, inputs. Farmers must accept reduced output and profits in order to decrease chances of loss. For example, fertilizer is costly and return from its application depends on the timing and quantity of water received by the crop. The rational farmer with inadequate irrigation water supplies will apply fertilizer at low levels in order to insure that his marginal costs do not exceed his marginal returns--a perfectly rational response to inadequate water supplies which sacrifices per acre productivity.

Yet, a good deal of the already insufficient 2.1 acre feet per year which is captured for potential use is lost in watercourse channels. In the early 1900's R. G. Kennedy (Jogleker, 1965:85) estimated seepage losses in the overall Punjabi irrigation system as about 47 percent--about 20 percent was estimated to occur in the main and branch canals, and about 27% in the distributories and watercourses leading to the fields. More recently Corey and Clyma have reported measurements of watercourse losses which range from five to sixty-five percent per mile in the Pakistan Punjab. In sum, improving watercourses to reduce spillage and seepage could improve the availability of desperately needed water. To investigate the behavior of village farmers regarding their decisions to clean watercourses, to change from more flexible kacha warabundi to less flexible pacca warabundi systems of water turn rotation, and to seek involvement of lower echelon irrigation officials is to investigate domains of real significance for the improvement of agricultural production.

Review of Literature

This section presents a review of the literature of village studies, particularly those with a focus on India and Pakistan, with the purpose of organizing key findings about two domains:

1) Structural attributes of village organization;

2) Interaction between villagers and bureaucracy.

The literature of village studies in India and Pakistan suggests three essential foundations for village social structure: (a) biradari ties, (b) the caste system, and (c) land tenancy statuses.

Biradari

The term is of Persian origin and a derivative of the word biradar meaning brother. Biradari literally means "brotherhood." For our purpose, biradari is generally an endogamous group of individuals who consider themselves related to each other through blood or marriage. The English synonyms are "kinship" or "extended family." Two other local terms used are kunmba and khandan. Eglar (1960:75) defined biradari as a patrilineage, whereas Korson (1969:153) included in it the blood relatives only and Blunt (1931:Ch.1) maintained that it is a specifically located ecological or geographical group. Biradari groups serve important economic and social functions.

> Because of the biradari endogamy, resulting in a multiplicity of relations, the break-up of the family due to death, especially that of the husband, minimizes the personal, social, and financial hardships for the surviving spouse and children--in a society where female literacy rate is extremely low, outside economic

> opportunities are almost non-existent, and there are no public welfare or social security programs. In case of such tragedies, the whole biradari consider it an obligation to care for the well-being of the bereaved family (Wakil, 1970:12-13).

Wakil (1970:13-14) further observes that the closely knit personal relations that prevail in Punjabi biradari system supersede all other loyalties.

> The formal rules and regulations of the official and non-official institutions and organizations are frequently ignored or violated. The claims on personal biradari relationships, whether real or 'synthetic', as mentioned above, supersede the observance of formal rules. The rules then are circumvented and result in confusion and erratic or unpredictable functioning of the elements of the various social structures. The situation is often fluid and uncrystallized and means a severe blow to efficiency so desirable in the emerging bureaucracies.
>
> Due to these reasons it seems likely that the emergence of a 'secondary' system of relationships based on rational orientations would be slow to emerge in the Punjab.

Castes

Caste usually connotes some notion of different occupation. It also has religious significance. In Punjab, simple division of labor divides rural people into military, agricultural, and artisan castes. The concern of the present study is with agricultural castes only--the Rajputs, Jats, and Arains. Each possesses traditional characteristics which provide criteria for delineating in- from out-group members. Each one has an associated sense of prestige and dignity which upholds the traditional behavioral patterns.

1. The Rajput: The Rajput (literally 'son of a Raja') is the aristocrat of the countryside, and that is his undoing. Proud of his birth and traditions, more accustomed to fight than to till, loving the bravura of life and scorning its drudgery, he is by common consent the worst cultivator in Punjab...If he is

of pure descent, he is forbidden to touch the plough; and even if he is not bound by this rule, where the Jat ploughs deep, he will only scratch the surface of the soil (Darling, 1947:33).

2. The Jat: No tribe is in stronger contrast to the Rajput than the Jat. If the former represents the gentry of the province, the latter is the marrow and soul of the peasantry. 'Unremitting in toil, thrifty to the verge of parsimony, self reliant in adversity, and enterprising in prosperity, the Jat... is the ideal cultivator and revenue-payer.
Assisted by his wife, the Jat will generally do better on a small holding than the Rajput on a large (Raza, 1969:29).

3. The Arain: Though often a farmer, he is by tradition and instinct a market gardener, and alone among cultivators rivals the Jat. 'For cattle,' says the proverb, 'give me the cow, and for a cultivator give me the Arain'...He produces more to the acre than any other tribe, but at a cost that most would consider prohibitive. To this life of unceasing toil he is driven by his prolific nature. Content with a low standard of living, he multiplies faster than any other important tribe, and his land is consequently split up into the minutest holdings (Darling, 1947:45).

Land Tenancy

This study will adopt the following classifications of farmers employed by Gibb, et al. (1966:16).

1. Owner cultivator: a farmer cultivating his own land for which he paid neither cash rent nor crop share. He might also rent out some part of his land to other farmers.

2. Owner cum tenant: besides farming his own land, this farmer also rents and farms land for cash, crop share or free. He might also farm mortgaged land for which he provides the money. Depending on the proportions of his owned and rented land this type of farmer at the extremes, of course, is indistinguishable from 'owner' or 'tenant.'

3. Tenant: This farmer pays rent for all the land he farms either in cash (cash renter) or crop share (share cropper).

4. Absentee Landlords: These are non-farming owners who may not necessarily be living in the village.

Caste and Kinship--Core of Village Social Organization

The literature of village studies reveals that village conflicts are based upon inter-kin and inter-caste hostilities and not upon differences in land tenancy status because of the great interdependence among the latter.

> Caste and kinship form the core of village social organization and this splits village into separate communities which have their close affiliations across village lines (Lewis, 1958:148).

Adams and Waltmade (1970:49-56) employed numerous field studies of Indian villages in constructing a model of village economy in traditional India. They have described joint or extended family as the basic unit of the village system:

> Families are grouped into endogamous castes that prescribe social rank, circumscribe social interaction, and define occupational categories.
>
> The Hindu religious writings account for the division of society into four vernas, or castes: Brahmans, or Priests; Kshatriyas, or Warriors; Vaisyas, or Merchants; and Sudras, or Laborers. A fifth 'caste' is made up of the casteless untouchables.
>
> Social alignments are seen by participants as being largely drawn within the framework of caste and kinship. The village community is spoken of as 'belonging' to the Zamindars (landlords) or the land owning peasant caste or castes, with others present to serve them. Alignments are spoken of as being based on biradari kin ties...In some contexts there is cohesion among kin, particularly close kin, though they frequently also oppose one another in factional disputes (Raulet and Uppal, 1970:344).

Sirivins (1955:29) observed that landowner-tenant relationships occasionally cuts across caste barriers, and this is more common when the landowners are permanently absent from the village. The relationship between landowner and tenant is also an intimate one. Like all intimate relationships, it is frequently marked by conflict. Tenants are heard complaining

about the exploitation of the resident landowners; many feel that absentee landowners have no right to receive income from the land.

Dube (1967:34) considers the joint family as the basic and primary unit of the society in the social structure of an Indian village. Every family belongs to an exogamous division of a caste and several such divisions constitute an endogamous caste or an endogamous section of a large caste.

In describing the social structure of village Shamirpet in Telangana, Dube (1967:39-40,49,135 has pointed out that:

1. All the castes are endogamous.
2. Most of the castes are further subdivided into endogamous division which for all practical purposes are themselves independent castes.
3. The type of family organization is patrilineal and patrilocal. The eldest male is generally regarded as the chief of the household and according to tradition, he must benevolently dominate the scene...The head of the family is answerable to the caste and the village councils for the members of his household.
4. Importance of the solidarity within the allied families (extended family) is emphasized, and it is expected that any major decision will not be taken by any branch without consultation with the senior members of these allied families.

Kumbapettai, studied by Gough (1955:36), is a Brahman village. "They have no elected leaders...Within each patrilineal extended family all submit to the oldest man."

In the past the village has also acted as political units in battles with neighboring villages. Sometimes battles arose as a result of boundary disputes between landlords of adjacent villages; in that case Brahmans themselves did not fight, but bands of non-Brahmans lesees and Pallan laborers of the two villages were assembled by their respective landlords and fought on the boundary.

> But today Brahmans complain that with the gradual loss of their economic power over the lower castes the loyalty of tenants and laborers is no longer what it was, and the unity of the village is declining (Gough, 1955:46).

Factionalism:

In the literature, there are two primary views of factions. One is suggested by Oscar Lewis (1958:Ch. 4). Lewis views factions as:

> Those small cohesive groups within castes which are the locus of power and decision making and contribute to the compartmentalized segmented nature of village social organization. The term faction used here, however, does not denote only opposition or hostile relations between groups, nor is discord and dissension necessarily the predominant quality in interfaction relations. The small groups which we have delineated are held together primarily by cooperative economic, social and ceremonial relations.
>
> He further observes that the factions are generally referred to by the names of their leaders or in some instances by the nickname of a lineage, that is, when the faction and lineage are synonymous.

Factions follow caste lines.

> For a faction to operate successfully over an extended period of time it must meet three conditions: (1) It must be sufficiently cohesive to act as a unit; (2) it must be large enough to act as a self-sufficient ceremonial group--for example, it must be able to summon an impressive number of relatives for a marriage party; (3) it must have sufficient economic resources to be independent of other groups. This means that it must have some well-to-do families that can rent out land or act as money-lenders for its poor members.
>
> Factions which enjoy the reputation of being relatively neutral and of having friendly relations with all other groups are the most influential in the village.
>
> There are some occasions, though these are relatively few and far between, when members of different factions come together despite their differences and unite for some common action. The major occasions are funerals, the building of village wells, the cleaning of the village pond (twice in the past forty years), the repair of sub-canals for irrigation, and certain holidays such as Holi and Tij. Moreover, there is a tradition of presenting an appearance of unity to the outside.

> The role of kinship in the composition of factions is extremely important. In questioning informants about the membership of their particular faction they tend to equate their faction with their kinship group, even when they are aware that the two may not entirely coincide. There is not a single case of brothers belonging to separate factions, only one case of first and second cousins, and only four cases (out of fourteen) of third cousins.
>
> The varying degree of cohesiveness of the factions appears to be a function of the size of the group, geographical compactness, closeness of kinship ties, the degree of economic self-sufficiency, the past history of factionalism, and the age of the group.

Lewis (1958:147) notes that contrary to a common misconception, factions are not political groupings, or temporary alliances of individuals to fight court cases, although some of them do take on political functions and become involved in power politics. Rather, they are primarily kinship groupings which carry on important social, economic, and ceremonial functions in addition to their factional struggles against each other.

The second view of factions is forwarded by Boissevian (1964:1275-1287) in his study of "Factions, Parties, and Politics in a Maltese Village." The author followed the lead of Harold Lasswell who defined a faction as "any constituent group of a large unit which works for the advancement of particular persons or policies." He also noted that "the term itself drops out of useage when certain lines of cleavage have become rather permanent features of the political life of a group, these divisions are accepted as parties" (Lasswell, 1931:49).

For Boissevian a faction is based on some temporary issue, whereas Lewis thought that there are permanent

factions in Rampur based on caste and kinship affiliations. For Boissevian the two permanent divisions are not factions--e.g., one religious division between the followers of St. Mogue and those of St. Martin, and the political cleavage between Malta Labor Party and opponent supporters of the Archbishop. People were divided into factions only when there was a temporarily controversial issue over some decision taken by a church minister.

Leadership Characteristics

The Wisers (1965:22) provide an account of the importance of leaders for farmers' decisions to change their traditional techniques of agriculture:

> The average farmer in our village listens with interest to an explanation of the advantages of a new variety of seed. But he would not risk trying it unless his leader had first tried it, or at least sanctioned it. He might be an enthusiastic observer of the demonstration of a Persian Wheel--a large wheel for raising water, fixed vertically with a number of buckets at its circumference--but he could not afford to buy one without a loan from his leader. And he would not think of asking for a loan until his leader had himself installed a wheel. He knows that if he should presume to outshine his leader in any detail, social or economic, he would be brought down forcibly to his station. It is his lot to wait for the signal to advance.

The Wisers (1965:14-15) further elaborate on how the villagers are dependent on the leaders:

> The ordinary villager looks to them for their wells. The waterways to his field must pass through their land. His animals graze on areas under their control. He borrows their bullocks in times of need. He has the privilege of collecting fuel from their land...Money for weddings is borrowed from them. Employment in slack times for some, and full-time employment for others, is supplied by them.

Any program of village change, therefore, cannot be initiated or sustained without knowledge of leaders. Certain attributes of village leadership have been explored by Singh (1968:72-75) in his case study of Village Mohali in Punjab, Delhi:

1. Leadership in the village is still regulated by caste.

2. The major leadership roles in the village are filled by the dominant caste. The important elements of dominance in the village are numerical strength, economic and political power, ritual status, and occupations.

3. If for some reason such as reservation of a seat, some person from lower caste is taken in the Panchayat, the upper class members on its body so manipulate the things that the former has to side with the latter in all affairs.

4. Leadership from one situation flows to other situations also. Almost the same persons occupy leadership positions in all spheres.

5. All the village leaders including leaders in different caste groups happen to be household heads.

6. Informal leadership is more potent force. The functions of village Panchayat are more specific in nature.

7. Generally, those who occupy more formal leadership positions in the village have more chances to be recognized as leaders in all other spheres which are not formally organized.

8. Advanced age is not necessary for village leadership provided other qualifications are present.

9. Education is becoming increasingly recognized as an important factor for leadership in the village.

10. Land ownership is another important factor for village leadership. Therefore, persons who are big land owners in the community happen to be village leaders.

11. The bases of leadership have widened with the rise of general consciousness, the village people now

recognize their leaders on different grounds. The common bases are free time, good economic conditions, honesty, popularity, effective outlook, ability to settle disputes, speaking ability, military service, reputed family, and contacts with officials and others.

12. Power now tends to be more diffused rather than centralized. Formerly a single person discharged many functions, and he was invested with wide powers. Now there are numbers of such persons to discharge these functions.

Oommen (1969:515-525), while comparing the attributes of an ideal leader and actual leadership, came up with the conclusion that among the qualities found in the present leaders the membership in dominant caste and kin group is the single most important attribute, the status of family following close behind. These two qualities scored nearly 50% of the total points.

The community image of an ideal leader was highly ethically loaded in Oommen's study. The attributes of truthfulness, disposition to help others, impartiality and education scored 45-68 percent of the total score. The striking differences between the ideal and actual leadership is that the attributes which scored heavily in one were relegated to the background in the other.

Panchayat (Village Council)

Although many of the leadership attributes described in the preceding pages are associated with the leadership role of Panchayat members, Panchayats are sufficiently important for routine village decision making as to deserve a separate subheading. Lewis (1958:29) in his study of village life in Northern India pointed out that "the establishment of a

new school, problems concerning land consolidation, the sending of a delegation to the revenue department--in all these matters the village Panchayat played the dominant role in recent years."

Somjee (1962:13-18) studied the politics of an Indian village and discovered that a shift from a purely nominated Panchayat by a government representative to one elected by the people of the village according to a mutually agreed formula changed the concept of Panchayat as an institution for "important" people. "From the purely caste basis of the first elected Panchayat, the governing factors of choice became a complex amalgam of caste, lineage, patronage, and security."

Panchayats are mostly at village level. Yet, Oscar Lewis (1958) found Panchayats for different castes in his village in Northern India and Dube (1967:55-66) discovered that there may be inter-village Panchayats. "They function as ad hoc arbitration committees. Conflicts between two villages, or between two parties belonging to different villages (and not drawn from one particular caste), often necessitates an inter-village Panchayat. In this situation the elders of the two villages which are parties to the dispute, as well as the elders from the neighborhood sit together, hear the dispute and give their verdict. Of course, they have no authority to enforce their decisions, and these days cases often go to the courts of law established by the government."

Villagers and the Bureaucracy

Janowitz (1958) attempted to conceptualize the citizen administrator relationship in democratic terms in his empirical study of public attitudes towards administration in Detroit, Michigan. He specified four types of requirements for the achievement of a democratic balance:

1. Knowledge: The public must have an adequate knowledge about the operations of the public bureaucracy.

2. Self-interest: The public must consider that its self-interest is being served by the public bureaucracy. As a check on the disruptive consequences of self-interested demands on the bureaucracy, the public must be aware simultaneously of the bureaucracy's capacity to act as a neutral and impartial agent in resolving social conflicts.

3. Principle-mindedness: The public must be of the general opinion that the public bureaucracy is guided in its actions by a set of principles guaranteeing equal and impersonal treatment. Administrative routines, however, must be sufficiently flexible to cope with individual differences in order to ensure adequate dealings with clients.

4. Prestige: Public perspective toward public bureaucracy must include adequate prestige value toward public employment as compared with other types of careers. Very low and very high prestige values would interfere with the bureaucracy's ability to operate on the basis of democratic consent.

What Eldersveld (1968:6-8) in his study of the Citizen and the Administrator in a Developing Country shows is strikingly different from what Janowitz proposes:

> The Indian public in Delhi state is inclined to feel that officials are doing a good job and supports developmental programs as whorhwhile. On the other hand, there is evidence that this public is not convinced that officials treat citizens equally, nor is a majority certain that action can be taken against officials who do not perform their job properly. There are cynical overtones to responses about the integrity of officials. Yet, the great majority look on governmental positions as highly valued.

Wisers (1965:101,107) in their discussion of Agents of Authority (Ch. VIII) observed that these agents were there simply to serve as links between the village and officials or landowners. The picture drawn by them is one of exploitation of villagers by their government officials. These are Headman, and Patwari of the Revenue Department:

> Headman: The office of the village headman is honorary. He is a resident of the village, appointed by the government to represent the village in all matters pertaining to authority. He knows the village and the history of every person in it better than any official could hope to, and is in a position to give useful information regarding offenders against the law.
>
> Patwari: The village Patwari and his one assistant are the only full-time agents of government in the village. With the Patwari is a record of every plot of land within the revenue area...what is grown on it, the names of its holders, and their individual rights in it. He enters in his volumes any changes brought about by death, with a statement of the rights of each heir. He notes transfers of holdings and any alterations in legal rights. Also he keeps a record of all rents paid to each landlord, and arrears. He must appear in court to give evidence in all cases dealing with land rights in his area. If more of our farmers could read, and if each of them would keep his own authorized copy of the record of his holdings made out by the Settlement Officer every thirty years, along with legal records of current transaction, our accountant (Patwari) would serve as an inoffensive employer. But as long as they do not do this and depend entirely on his annual recordings of their rights, they vest him with powers which he, a low grade agent, could hardly be expected to disregard.

Concluding Remarks

The essential points raised by the review of literature can be summed up as follows:

1. Caste, kinship and different land tenancy statuses are central parts of village social structure.
2. Often caste, kinship, and land tenancy differentials solidify groups into contending factions, becoming potential sources of a network of hostility.

3. Village leadership exists either in the form of a Panchayat or some key individuals who perform the leadership role in the village. But traditionally the leadership is dependent on dominance of caste or kinship or ownership of land.

4. Government bureaucracy occupies a crucial position in the village social structure, government officials are seen by the villagers as having prestige and honour. People attach high value to being a civil servant. However, they do not see officials as effective agents of change. They perceive them as favoring certain segments of society while depriving others of the benefits of new development programs.

These points help mark the conceptual boundaries regarding the factors potentially relevant to explaining water management behavior. This study will employ them in an effort to ferret out social factors associated with differential willingness to clean watercourses, to change warabundi systems, and to involve irrigation officials in water management decisions.

Methodology

Given the absence of a sociological literature specifying variables significant to the explanation water management decision behavior, this study was conceived as an initial, highly tentative, effort to ferret out sociological variables associated with different patterns of water management behavior. The primary objective is to lay the basis for future sociological research by developing some testable hypotheses. The absence of an existing body of knowledge combined with other resource limitations precluded any substantial hypothesis testing effort.

The approach of this study is that of a descriptive case study primarily utilizing qualitative analysis of data to compare and contrast the impacts of public tubewell augmentation of water versus watercourses not augmented by public tubewell supplies on three aspects of water management decision making--decisions to clean watercourses, decisions to switch warabundi; and decisions to involve officials of the irrigation bureaucracy. Variables having to do with village organization, such as caste, land tenancy, and leadership are investigated as intervening factors conditioning the effects of the independent variable (augmentation of water) on the dependent decision variables.

The design for the research is as follows:

I. The Focus of inquiry is on three dependent variables--village farmers decisions to:

   A. Clean and maintain watercourses

   B. Change from kacha to pacca warabundi

   C. Involve or not involve lower level irrigation authorities in decision making--the patwari, the pansal nawees, the overseers, and in the cases of those villages served by a public tubewell, the tubewell operator.

II. Intervening Variables--Village Social Organization Attributes:

   A. Number of castes in the village--single, double, multiple; the primary agricultural castes are Jats, Rajputs, and Arains. For purposes of assigning villages to the categories of single, double, or multiple caste type, only agricultural castes were counted. If non-agricultural castes are counted, there are no truly single caste villages in Pakistan.

   B. Presence/absence of factions in the village which are based on criteria of kinship, caste affiliation,

or some common interest, economic or political in nature, old or new. Factions are deemed to be present only when overt hostility is present between two or more groups. This hostility is manifested at least in the sense that some villagers were "not on speaking terms," and in the most serious sense "danger of armed combat any time."

C. Leadership structure--key individuals/organized Panchayat--Decision making may be conducted through an organized panchayat or by individual farmers with the requisite power, prestige, and wealth. Where there is no active panchayat, this study is interested in the characteristics of the individual decision makers in terms of their affiliations to caste, biradari (patrilineage), and land tenancy status.

D. Land Tenancy Type--Presence/absence of large landlords--defined as those with landholdings of fifty acres or more.

E. Pattern of Residence--Locals/Muhajirs--"Locals" are those villagers who have been settled in the area since the end of nineteenth century when the canal irrigation system was developed by the British. "Muhajirs" are migrants who came to Pakistan from East Punjab (India) at the time of partition in 1947. The terms "Local" and Muhajir" are in vogue only locally and do not have official sanction.

III. Independent Variable--Presence/absence of public tubewells, to augment canal water supplies, installed and operated by the Water and Power Development Authority of Pakistan.

IV. Control Variables:

A. There were no private tubewells in any of the sample villages;

B. Accessibility to the nearest city, Tehsil administrative headquarters was controlled to the extent that each village in the sample is located within a one day round trip distance by bus or tonga;

C. The interviewing focused on farmer water management decision making behavior during the winter (rabi) cropping season when rainfall is negligible and irrigation is most crucial.

Two sets of villages were randomly chosen for study--one set of eight villages are located in an area the watercourses of which are not served by public tubewells to augment canal water supplies.

A second set of seven villages are located along watercourses which are augmented by water supplies from public tubewells. Table 1 shows the key organizational properties of the fifteen villages in the sample. It is clear that hypothesis testing about the effects of the several village organizational variables is not possible given the distributions of organizational attributes.

TABLE 1

Organizational Properties of the Villages in the Sample

Village Properties	Unaugmented Watercourses	Augmented Watercourses
Multi-caste	3	5
Double-caste	1	1
Single-caste	4	1
Locals	3	5
Muhajirs	5	1
Local (in majority)	-	1
Big landlords	-	5
No big landlords	8	2

Two interviewing schedules were employed to record data in each village.

1) Schedule one was constructed to measure properties of village social organization. The information was mainly gathered from the village lumbardar (headman). Where he lacked full information he referred to

somebody else in the village such as a village chowkidar (Watchman) or a revenue Patwari (the government revenue assessor). The lumbardar and the chowkidar are village residents, and, therefore, know the background of factions and disputes. The revenue patwari records information about the number of households, size of land holdings, and caste membership. Where necessary the questions on factionalism and disputes were directed towards other key individuals such as school teachers or shopkeepers.

2) Schedule two was administered to at least three farmer informants in each village--one each from different locations on the watercourse--the head, middle, and tail. Because of the earthern nature of watercourses, the water flow is not generally uniform throughout the channel. Farmers in different locations could be expected to provide varying assessments of their requirements. Although random selection of the informants could not be achieved, the researcher took care to insure that he secured informants from each of the three locations on the watercourse.

Findings and Hypotheses

General Observations

Total agricultural land and the size of holdings differ from village to village within each of the two samples, but

the most striking differences are revealed between sample villages with and without public tubewells to augment canal water supplies. An examination of Table 2 shows that villages with augmented water supplies have a substantially larger average landholding size.

Land is highly fragmented in both sets of villages. Informants consistently used six acres as the definition of a minimum subsistence farm size; if such a figure is used this of course means that a majority of the landowning households in the sample of unaugmented villages cannot meet basic subsistence needs from their owned land--such families must hire their members out to larger landowners or leave the village to work in cities.

Moghas (canal outlets) are not allocated in any definite proportion to the total irrigated area in either augmented or unaugmented villages (see Table 3). The maximum area being irrigated by one mogha is 40 squares (1000 acres) and the minimum on one watercourse is seven squares (175 acres). Where there is more than one mogha per village, the allocation of agricultural land on each is not in equal proportion. Irrigation Officials related that the allocation is determined by three factors: (a) A group of farmers who do not want to share water with others might have a separate mogha; (b) the scheduling of water under pacca warabundi might not be adjusted to include every farmer on particular moghas; (c) the particular position of a mogha might create problems with regard to capturing an adequate flow of water to serve an

TABLE 2

Landholding Sizes in Villages with Unaugmented and Augmented Canal Water Supplies* (Acres)

Village Identification	Largest holding	Smallest holding	Average holding	Village Identification	Largest holding	Smallest holding	Average holding
U_1	18.0	.25	2.5	A_1	100.0	1.0	21.0
U_2	12.5	2.0	3.0	A_2	25.0	1.0	4.0
U_3	25.0	2.0	4.0	A_3	37.5	3.0	8.0
U_4	37.5	1.0	3.0	A_4	225.0	6.0	20.5
U_5	22.0	1.0	1.75	A_5	125.0	3.5	10.0
U_6	37.5	1.0	1.75	A_6	100.0	6.0	15.0
U_7	37.5	2.0	3.5	A_7	75.0	5.0	7.0
U_8	18.0	.25	3.75				

*Note: Average landholding sizes calculated by dividing the total agricultural area of each village by the total number of agricultural households in each village.

U = Unaugmented Village

A = Augmented Village

TABLE 3

Number of *Moghas* and Area Irrigated

Village Identification	Total irrigated area (squares)*	No. of *moghas*	Average irrigated area per *mogha* (squares)	Area with the *mogha* under study (squares)	Area with other *moghas* (squares)
Unaugmented Villages					
U_1	75	4	18.75	16	20, 20, 19
U_2	40	1	40	40	---
U_3	40	1	40	40	---
U_4	85	3	28.33	25	30, 30
U_5	48	3	16	18	18, 12
U_6	35	3	11.67	7	11, 17
U_7	80	3	26.67	20	30, 30
U_8	90	4	30	18	23, 22, 27
Augmented Villages					
A_1	45	2	22.50	24	21
A_2	50	2	25	24	26
A_3	64	3	21.33	30	15, 16
A_4	57	2	28.50	27	30
A_5	40	2	20	18.5	21.5
A_6	39	3	13	17	16, 6
A_7	55	2	27.50	27	28

*Note: A "square" is a land area equal to 25 acres.

entire watercourse. In all cases, however, the allocation of water for each farmer is based on his land holdings. The more land a farmer possesses the longer time he is granted for his turn.

The primary agricultural castes in the sampled area are Jats, Rajputs, and Arains. No village is exclusively inhabited by an agricultural caste. Non-agricultural castes which are numerically significant in a village are included in Table 4a and 4b. Taking into consideration agricultural castes only, there are four single caste, one double-caste and three multi-caste villages in the sample of unaugmented villages. Among the seven augmented villages in the sample, Table 4b reveals that there is one single caste village, two double caste villages, and four multiple caste villages.

In five of the unaugmented villages (U_1, U_2, U_3, U_5, U_8), all agricultural households are Muhajirs--persons who migrated from India in 1947. In the remaining three villages with unaugmented canal water supplies (U_4, U_6, U_7), all members of the agricultural castes are locals who settled on the land before partition. Muhajirs constitute all of the agricultural castes in village A_2 and 31 percent in village A_1. The remaining five augmented villages have their agricultural castes composed of "Locals."

When questioned about the personal attributes of the dominant individuals in all villages informants agreed that they had respect and prestige stemming from their landholdings. Menials could get wheat and fodder from them in emergencies

Table 4a

Household Distribution of Agricultural Castes *Vs.* Non-Agricultural Castes--Unaugmented Villages

Village	Total no. of households	No. of agricultural caste households	Name of the agricultural castes with number of households		Recognized sub-castes		Number of major non-agricultural caste households
U_1	1,000	700	*Jat:* *Syad:*	350 350	None		200 (*Easi*: Agri. labor & sweeper)
U_2	1,000	336	*Rajput:* *Gujjar:* *Arain:* *Syed:*	300 25 10 1	None		250 (*Changar*: Agri. labor)
U_3	300	250	*Rajput:*	250	*Manj:* *Kotlas:*	80 170	30 (*Teli*:oil seed presser)
U_4	1,000	700	*Arain:*	700	None		None
U_5	1,000	707	*Jat:*	707	*Randhawa:* *Sindhoo:*	700 7	None
U_6	750	500	*Arain:*	500	None		250 (*Easi*: Agri. labor & sweeper)
U_7	700	550	*Jat:* *Dogar:* *Arain:* *Rajput:* *Gujjar:*	300 200 20 15 15	None	100	(*Jolaha*: weaver)
U_8	800	615	*Jat:* *Arain:* *Rajput:* *Kamboh:*	200 200 200 15	None		35 (*Teli*: oilseed presser)

Table 4b

Household Distribution of Agricultural Castes *Vs.* Non-Agricultural Castes--Unaugmented Villages

Village	Total no. of households	No. of agricultural caste households	Name of the agricultural castes with number of households		Recognized sub-castes	Number of major non-agricultural caste households
A_1	350	52	*Syed:*	2	None	150 (landless laborers)
			Kharl:	19		
			Arain:	15		
			Gujjar:	16		
A_2	350	300	*Rajput:*	75	None	40 (*Jolaha*: weaver)
			Arain:	120		
			Jat:	75		
			Khokhar:	30		
A_3	300	192	*Rajput:*	42	None	75 (*Jolaha*: weaver)
			Jat:	50		
			Arain:	100		
A_4	150	69	*Rajput:*	7	None	40 (*East*: Agri. labor & sweeper)
			Jat:	23		
			Arain:	34		
			Pathan:	5		
A_5	150	90	*Jat:*	70		25 (*East*: Agri. labor & sweeper)
			Pathan:	20	*Lodhi, Afridi, Saidu-Zai*	
A_6	250	65	*Rajput:*	35	*Minhas, Janjua*	100 (landless
			Arain:	30		
A_7	300	200	*Baluch:*	200	None	None

and small farmers could borrow seed and fertilizer. Dependent smaller cultivators can be counted upon to obey dictates of the landlords. Police officials or other civil servants coming to the village are always hosted by the landlords. None of the explanation of leadership dominance was attributed to qualifications of age, education, representative views, or personal honesty. The only criterion for leaderhip is land, and the financial status that comes with land ownership. In both unaugmented and augmented villages, "key" individuals exercise all leadership in decision making. Where panchayats exist, the decisions are actually those of the individual "influentials." These leaders are identified by the villagers according to two interdependent criteria: a) they are financially well off with a land ownership of 50 acres or more in lieu of which they earn an income of Rs. 20,000 or above per annum; b) they have influence at least in the lower echelons of the police, revenue, and/or irrigation departments.

A comparison of the total irrigated area of the augmented and unaugmented size of villages reveals that there is no significant difference as shown in Table 5. The value of 't' reveals a nonsignificant difference at a level of .10.

Public tubewell augmentation of watercourses is inversely related to the pressure on land in the sample villages. Data on average size of landholdings reveal that there is significant difference (at .01 level) between the two sets of villages--unaugmented and augmented (See Table 6).

Table 5

Relationship Between Size of Village (Total Irrigated Area) and Augmentation of Water

Village	Total Irrigated Area (squares)*	Village	Total Irrigated Area (squares)*
U_1	75	A_1	45
U_2	40	A_2	50
U_3	40	A_3	64
U_4	85	A_4	57
U_5	48	A_5	40
U_6	35	A_6	39
U_7	80	A_7	55
U_8	90		
$t = 1.24$ ($p > .10$)		df = 13	

*One square equals 25 acres.

Table 6

Relationship Between Average Size of Landholdings and Augmentation of Water

Unaugmented Water		Augmented Water	
Village	Average Irrigated Area (acres)	Village	Average Irrigated Area (acres)
U_1	2.50	A_1	21.50
U_2	3	A_2	4
U_3	4	A_3	8
U_4	3	A_4	20.50
U_5	1.75	A_5	10
U_6	1.75	A_6	15
U_7	3.50	A_7	7
U_8	3.75		
$t = 3.87$ ($p < .01$)		$df = 13$	

This implies that less water is made available where there is more pressure on land.

On the average there are 25 1/2 squares of land irrigated by one mogha in unaugmented areas, whereas 22 squares of land is irrigated on the average in augmented watercourses. Not much difference is accounted for by differences in the size of irrigated areas. The difference appears to be more due to the size of holdings because an average of 199 agricultural households with unaugmented water share one mogha as compared to 61 sharing a mogha with augmented water.

In unaugmented villages the length of the watercourses on the average is comparatively greater--1.55 miles as against an average of 1.30 miles in unaugmented water. The ratio between the two lengths is 10:12. This is much less than the ratio between the number of households (10:33) in the two sets of villages. This implies problems of coordination and cooperation in decision making among members of an unaugmented watercourse. There is also more diversion of water, and greater likelihood of more water loss.

The augmented villages, as compared to those without tubewell supplies, possess more moghas per square of land, they tend to have smaller amounts of land under irrigation per mogha, and there are fewer households sharing in the available water. It is clear that farms on the augmented watercourses in the sample villages are substantially larger, on the average, than their counterparts on unaugmented watercourses. The presence of larger landlords on augmented

watercourse may be a positive force to attract the irrigation bureaucracy to be more attentive to the problems in their villages--a fact which may explain the greater proportion of moghas.

The fact that there are 3.5 times more persons sharing water from one mogha in unaugmented villages than in those with public tubewells must make for greater difficulties of water management decision making when as many as 199 farmers share one watercourse. The researcher must confront the fact that substantially different farm sizes enters as a variable that confounds comparison between augmented and unaugmented villages. However, influence of this variable should be in the following direction--the fewer the farms the easier to mobilize watercourse cleaning effort (Olsen, 1971). However, observations (see following section on watercourse cleaning, esp. p. 40-42) show that the augmented villages with fewer farmers and greater average farm size in fact do not mobilize more than their counterparts in the unaugmented villages. It is suggested that the relative absence of more mobilization of effort is due to the presence of additional amounts of water made available by the tubewells.

On unaugmented watercourses, people with holdings smaller than four-six acres prefer not to stay in the villages. They do not produce enough from their lands for subsistence and many seek employment in Lyallpur. In so far as they secure outside employment, they may not be so much concerned to

pursue allocation of new moghas, although this is a subject for research in itself.

Decision to Clean Watercourses

Watercourses are cleaned from twice a year to twice a month. (See Chart 1.) Watercourses with supplemental supplies of tubewell water show less variation in the number of times they are cleaned annually, and Chart 1 shows that this reduced variation reflects the considerable lower levels of cleaning activity in augmented watercourses.

There is considerable variation in the length of a watercourse from village to village. It is also noteworthy (see Table 7) that watercourse length does not depend on the area irrigated, in either unaugmented or augmented villages.

The number of persons participating in cleaning is determined by the area irrigated, not by watercourse length. In unaugmented villages, generally two persons per square of irrigated land are employed (Table 8).

In all of the sample villages cleaning is the collective responsibility of all who cultivate land on a particular watercourse. But it was further noticed that only in three villages (U_2, U_4 and A_7) would all workers participate from head to tail. In all other cases, workers would clean only up to the place one's individual ditches branch off. People drop out as they finish with the portion on their own land leaving those persons further downstream to work more.

The discussions about cleaning the watercourse are nowhere systematic and regular. People may be found

Chart 1

Frequency of Watercourse Cleaning by Village

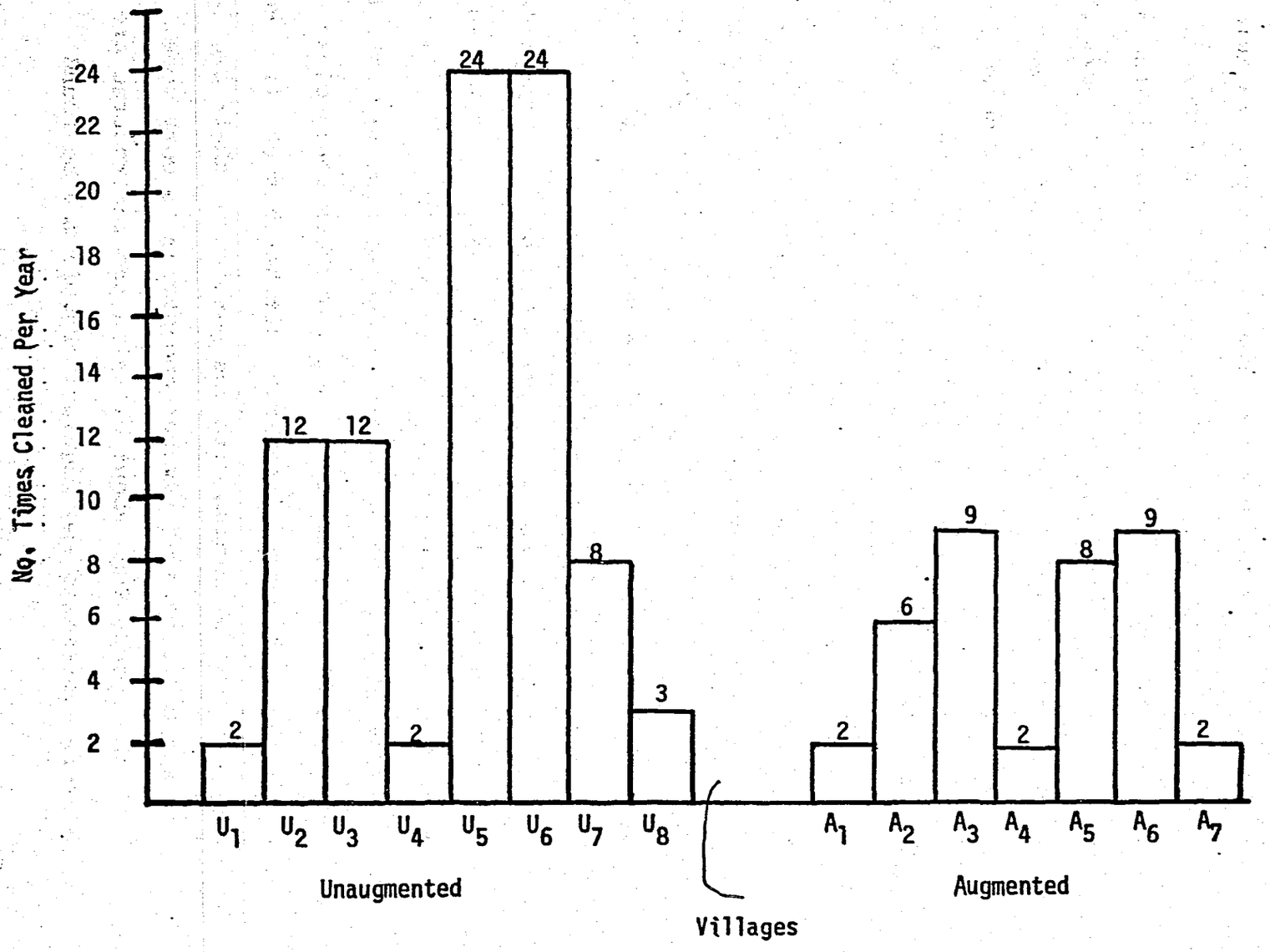


Table 7

Length and Area Irrigated by Each Watercourse

	Village	Length of the Watercourse (miles)	Area Irrigated by This Watercourse (squares)*
Unaugmented Villages	U_1	1.0	16
	U_2	3.0	40
	U_3	1.4	40
	U_4	3.0	25
	U_5	1.0	18
	U_6	1.0	7
	U_7	1.0	20
	U_8	1.0	18
Augmented Villages	A_1	2.0	24
	A_2	1.4	24
	A_3	0.6	30
	A_4	1.6	27
	A_5	1.4	18 1/2
	A_6	1.2	17
	A_7	1.0	27

*One square equals 25 acres.

Table 8

Number of Men and Number of Days Taken to Clean Watercourse by Village

	Village	Length of the watercourse (miles)	Total No. of men working each time	Workers per square	No. of days
Unaugmented	U_1	1.0	32	2	1
	U_2	3.0	200	5	2
	U_3	1.4	80	2	1
	U_4	3.0	50	2	2
	U_5	1.0	36	2	1
	U_6	1.0	14	2	1
	U_7	1.0	40	2	1
	U_8	0.6	36	2	1
Augmented	A_1	2.0	48	2	1
	A_2	1.4	96	4	1
	A_3	0.6	120	4	1
	A_4	1.6	27	1	1
	A_5	1.4	18	1	1
	A_6	1.2	17	1	1
	A_7	1.0	54	2	2

discussing the matter in mosques or in their fields. Discussions intensify when cleaning has been delayed. There are three ways of informing people about the time and day of cleaning the watercourse: (a) announcements are made on a loudspeaker where there is one at the mosque; (b) drum beating by the village musalli and (c) the village chowkidar may go from door to door telling all that their watercourse needs cleaning.

In most villages there exists some punishment mechanism to enforce cooperation. Two types of punishments prevail. First, a fine may be levied of Rs. 5/- per person not participating in cleaning. This amount is usually spent on sweetmeats. In two villages this money is kept safe by the village panchayat or khala chowkidar and used to repair nakkas or for hiring labor to replace absentees. The second sanction is to leave the absentee's portion undone. If the absentee farmer does not clean his share by the next day, his neighbor will do it and obtain a share of the delinquent's water.

In all sampled villages, except U_1 and U_8, informants indicated satisfaction with the system of watercourse cleaning. In some cases informants qualified their statement of "satisfied" as "very" or "very much." They uniformly suggest only one improvement--that watercourses should be lined. Regarding the cleaning system, some informants pointed out that all members should work jointly all the way from the mogha down to the tail. The people at the tail

have to work disproportionately hard. If the water flow is blocked near the middle, those upstream typically do not assist, whereas if there is an impediment upstream, all below the obstacle must work to correct the situation. Informants in U_1 and U_8 expressed a desire to change the mogha position because of problems with silting--and hence cleaning.

The highest number of cleanings, twice a month or 24 times a year, in two of the villages cannot be related to villagers' greater concern for watercourse quality. Neither is it due to any more silt or to an inadequate location of the mogha as compared to the villages doing cleaning jobs once a month. Informants in these villages made it clear that the work done was usually incomplete and therefore had to be frequently repeated. Therefore, frequency of cleaning is not necessarily associated with watercourse quality. More frequently cleaned watercourses may be leaky, crooked, retain excessive water in dead storage, and provide inadequate head.

In each case of watercourse cleaning a man day/mile/year was computed. It came out to be 515 man days/mile/year on the average in unaugmented villages and 391 man days/mile/year on the average in augmented villages. The value of 't' in Table 9 indicates that there is no significant difference between the two sets of villages: unaugmented and augmented with regard to the man days/mile/year.

Based on information made available through the informants, an argument can be suggested that the difference

Table 9

Man Days Per Mile Per Year by Unaugmented and Unaugmented Villages

Unaugmented Water		Augmented Water	
Village	Man days/ mile/year	Village	Man days/ mile/year
U_2	1600	A_3	1800
U_5	864	A_2	411
U_3	686	A_7	216
U_6	336	A_6	128
U_7	320	A_5	103
U_8	180	A_1	48
U_4	67	A_4	34
U_1	64		
$\bar{X}$ = 515		$\bar{X}$ = 391	

$t = .407$ $(p > .10)$ $df = 13$

between man days/mile/year on unaugmented and augmented watercourses is substantively significant. Informants in the augmented villages attributed their lower level of effort to availability of additional tubewell water. After installation of tubewell, there is no instance of farmer missing a water turn. Much water might be lost close to fields of large landlords but their personal ditches are still filled according to their needs. This loss of water might seriously affect farmers at the tail, but such villagers typically cannot initiate any cleaning or maintenance work on the common watercourse because of lack of personal influence associated with their smaller land holdings. The very small number of persons cleaning watercourses in most of the landlord dominant villages with tubewells most likely consist of farmers located at the tail.

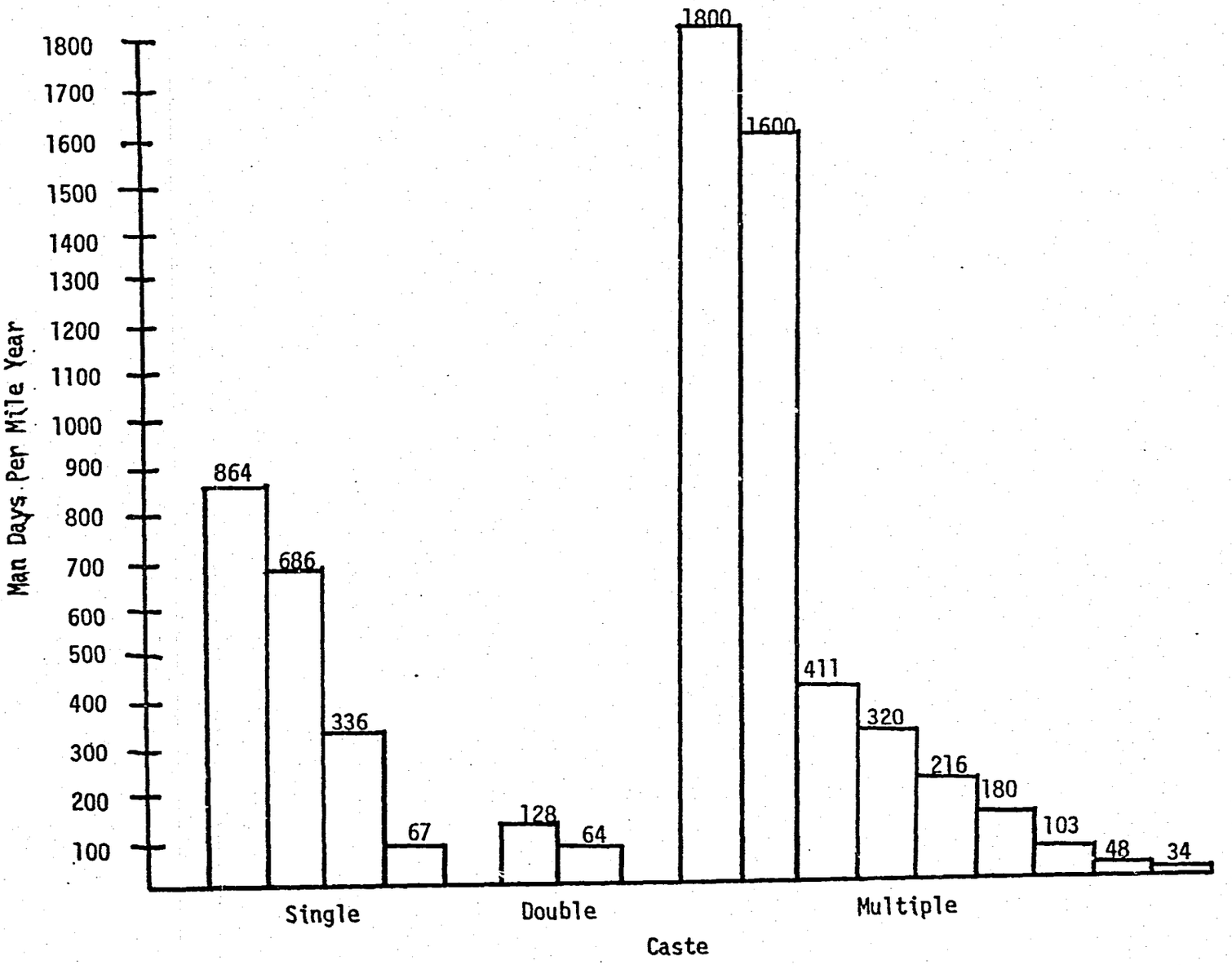
Man days per mile per year, if taken as indicative of mobilization of effort to clean watercourses in both unaugmented and augmented villages, is quite possibly related to several intervening variables such as caste structure, pattern of residence, pattern of leaderships, and presence/absence of large landlords in the village.

There is nothing conclusive about single and multiple castes but the double caste villages in each category of unaugmented and augmented water are those which mobilize the least effort in watercourse cleaning as shown in Chart 2.

The extremely small number of single and double caste villages prohibits statistical testing for a relationship

Chart 2

Man Days/Mile/Year in Relation to Village Caste Structure



here, but there is reason to think that the caste structure of villages may well have something to do with capacity to mobilize manpower for watercourse cleaning. It might be posited, for example, that double caste villages tend toward social polarization making it more difficult for farmers in them to engage in collective effort than in the case of either single or multiple caste villages. If this should prove to be the case, this finding would have significant policy implications for selection of villages in which to introduce any technological innovation requiring collective effort--e.g., watercourse re-alignment and lining.

Muhajir villages appear to mobilize more man days/mile/year to cleaning their watercourses. (See Chart 3.)

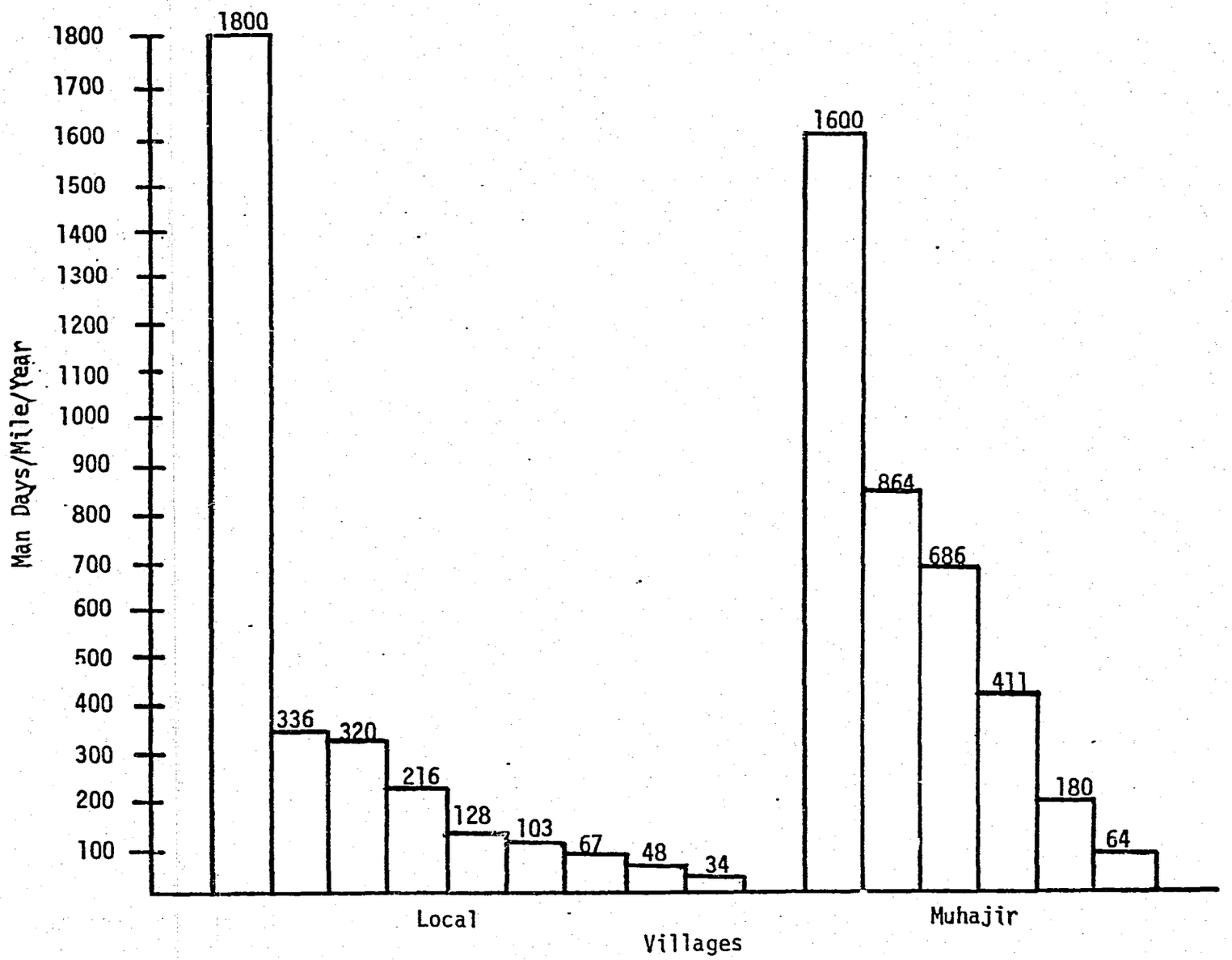
Yet a "t test" establishes that there is no statistically significant difference even at the alpha level of .10. Given the small number of villages in the sample, however, differences between "local" and "muhajir" villages are probably worth further examination.

There are no large landowners (defined as owning 50 or more acres) in unaugmented villages. However, data on augmented villages reveal that small owners tend to mobilize much more effort than the villages where large landowners are present. (See Chart 4.)

A "t test" establishes that there is a statistically significant difference between the two groups at the alpha level of .10.

Chart 3

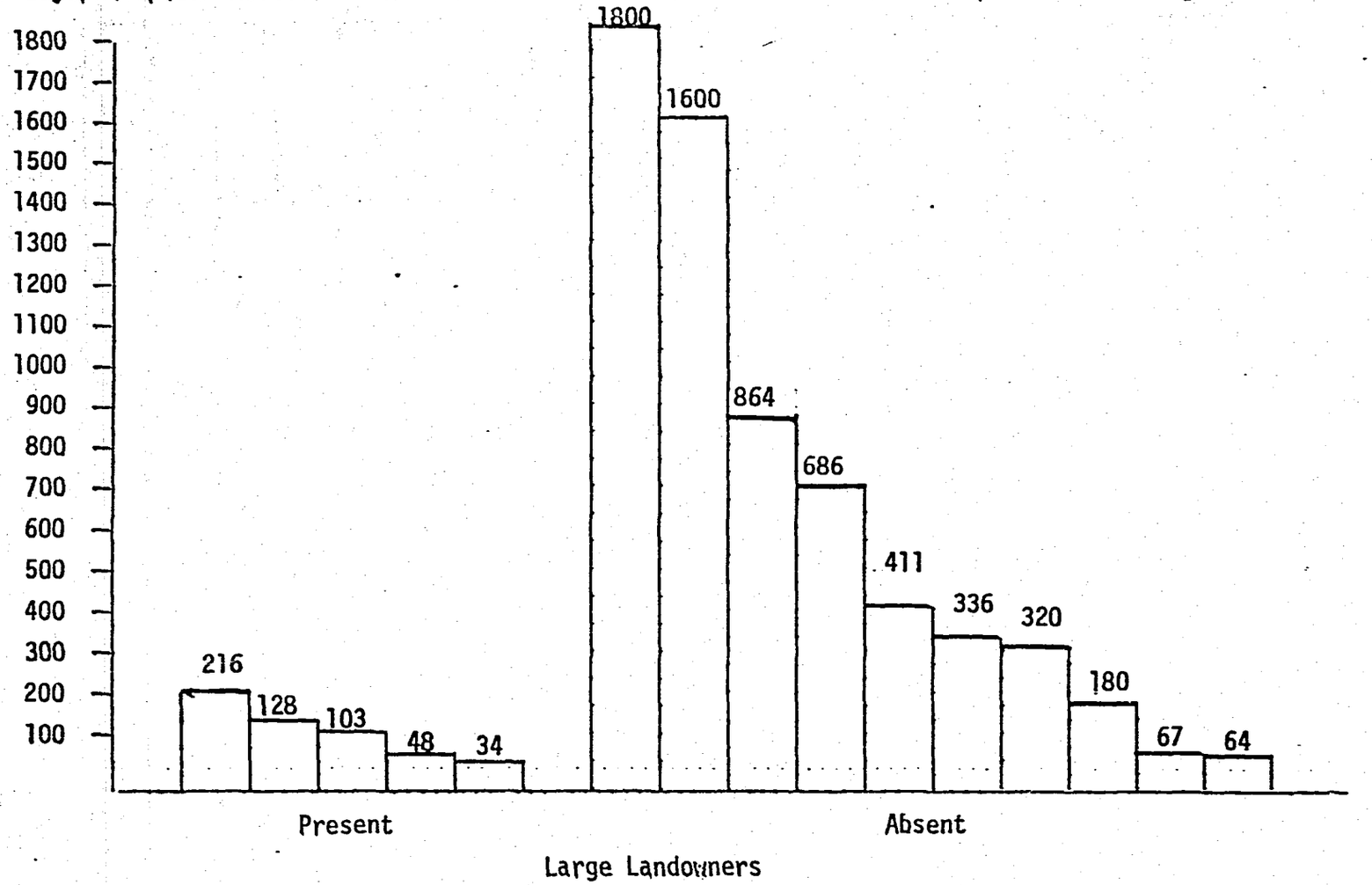
Man Days/Mile/Year Mobilized for Watercourse Cleaning in Relation to Residence Pattern



t = 1.054 (p > .10) df = 13

Chart 4

Man Days/Mile/Year Mobilized to Clean Watercourses in Relation to Presence/Absence of Large Landowners



$t = 1.865$ $p < .10$ $df = 13$

Decision to Switch from Kacha to Pacca Warabundi

Influential persons, with large landholdings, tend to take advantage of small farmers in the allocation of water turns under kacha warabundi system. In case of conflict, most other villagers side with the "influential(s)." If a case is referred to the police or Irrigation Department, the outcome typically is to the advantage of the more wealthy. Those at the head of the watercourse, near the mogha, can steal water from those toward the tail. According to informants this was particularly so on long watercourses where a thief cannot easily be caught.

Disputes over water shares arise for at least three primary reasons: 1) on occasion a farmer views the canal flow during his "turn" to be inadequate and therefore attempts to take additional time to irrigate; 2) watches are turned "fast" or "slow" to the advantage of one party's irrigation period; and 3) disputes among larger landholders are sometimes resolved by enlarging their share at the expense of smaller farmers. The most feasible approach to resolution of serious water conflicts among farmers in a kacha warabundi system is to petition the irrigation department for installation of a pacca warabundi system whereby each farmer's turn is formally fixed.

Table 10 displays information about those farmers who petitioned for the pacca system and it reveals something about the support the petitioner secured from other farmers on the khala (watercourse). In eleven of the thirteen

Table 10

Characteristics of the Farmers Who Initiated Change of *Warabundi* by Village

	Village	Number members who initiated petition	Position in the village	Caste (with recognized subcaste if any)	Landholding	Position on the water-course	Number of other petition signers
Unaugmented	U_1	2	-	*Jat*	12 1/2 acres each	Tail	1/2 of *khala* members
	U_3	1	-	*Rajput (manj)*	12 1/2 acres	Tail	3/4 of *khala* members
	U_4	4	-	*Arain*	4 to 5	2-Middle 2-Tail	3/4 of *khala* members
	U_5	2	-	*Jat (Randwala)*	15 & 18 acres	Middle	All members
	U_6	1	-	*Arain*	12 1/2 acres	Tail	All members
	U_7	1	-	*Dogar*	12 1/2 acres	Tail	All members
	U_8	2	-	*Rajput*	17 & 18 acres	Tail	No one else
Augmented	A_1	1	-	*Kharl*	2 acres	Middle	No one else
	A_2	1	*Lumbardar*	*Arain*	25 acres	Middle	1/2 of *khala* members
	A_3	1	-	*Arain*	1 1/2 acres	Tail	No one else
	A_4	1	*Lumbardar*	*Rajput*	225 acres	Head	1/2 of *khala* members
	A_6	1	*Lumbardar*	*Rajput*	50 acres	Middle	1/4 of *khala* members
	A_7	1	*Lumbardar*	*(Baluch Inait-Kel*	75 acres	Head	No one else

Note = U_2 and A_5 remained on *Kacha Warabundi* system at the time of this study.

sampled villages (85%) which undertook the switchover, petitions for the change originated with farmers at the middle or tail positions on the watercourse. Two very small landholders in augmented villages A_1 and A_3 initiated petitions and in each case no one else on the watercourse signed. Informants revealed that each was backed by large landowners--the small farmers took their action on the basis of a pre-arranged mutual consensus of their larger associates.

In all villages, augmented and unaugmented, informants took the position that the pacca system of warabundi is supported by villagers because it reduces serious, and sometimes violent, water conflict--this despite the loss of flexibility of water allocation and the fact that farmers run the risk of finding that the canals are dry during their particular fixed turn, a fact that cannot be remedied under pacca warabundi.

Table 11 shows the minutes of turn per acre by village under the two systems. There can be no change in the overall supply of the water, but individual farmers might well witness an increase or decrease in their supplies as a consequence of the switch. There was no way available by which specific gains and losses of water of individual farmers could be determined.

Interaction With Authorities

This part of water management decision making was difficult to ferret out. Informants clearly understood that initiation of this sort of contact was intended to secure

Table 11

Estimate of Water Supply Before and After Change of *Warabundi* System by Village

	Village	Minutes of turn per acre under *kacha warabundi*	Minutes of turn per acre under *pacca warabundi*
Unaugmented	U_1	30 minutes every 11 days	22 minutes every 7 days
	U_3	12 minutes every 12 days	8 minutes every 7 days
	U_4	29 minutes every 15 days	14.5 minutes every 7 days
	U_5	30 minutes every 12 days	22 minutes every 7 days
	U_6	86 minutes every 11 days	53 minutes every 7 days
	U_7	30 minutes every 12 days	17 minutes every 7 days
	U_8	30 minutes every 17 days	12.60 minutes every 7 days
Augmented	A_1	29 minutes every 12 days	24 minutes every 11 days
	A_2	30 minutes every 14 days	15 minutes every 7 days
	A_3	21.6 minutes every 10 days	12 minutes every 7 days
	A_4	19.2 minutes every 12 days	14.4 minutes every 7 days
	A_6	29 minutes every 10 days	22 minutes every 7 days
	A_7	44 minutes every 10 days	29 minutes every 7 days

Note = Villages U_2 and A_5 are not included because they had not switched from *kacha* to *pacca warabundi*.

favors from the lower level irrigation authorities--Patwaris, Pansals Nawees, and Overseers plus the Tubewell Operators in augmented areas.

Patwari

Farmers interact with Patwaris when they obtain their revenue assessment during each crop season. Everywhere, the researcher was informed that it is the Patwari who approaches the farmers. The Patwari makes two assessments for each crop; one is tentative and the other final. This means he approaches every farmer at least four times a year. Informants estimated the average number of farmer visits per year with a Patwari to range from five to eleven in the sampled villages.

In every village, farmers seek reductions in crop revenues by having some portion of the crops declared as kharaba. Larger landholders (50 acres or more) typically bargain for concessions and for the fraction of the concession which should be rebated to the Patwari. Farmers with holdings below fifty acres usually operate with a formula dividing equally the amount saved through concessions between the farmer and the Patwari.

Pansal Nawees

A pansal nawees (literally meaning a "Gauge reader") operates a gauge at the origin of a minor or a sub-minor canal, and sends daily reports to higher irrigation authorities about the quantity of flow in the canal. A report of "short" constitutes a request for more water, whereas a report of

"overflow" will lower the water level the next day. A report of "short" is considered to be favorable to farmers. A pansal nawees may favor--or create a disadvantage for--several watercourses at a time.

There are four villages in unaugmented watercourses where the villagers discuss water allocation with the pansal nawees. The frequency of visits in these villages is estimated to average from four to twelve times per year. Of the four unaugmented villages in which there is no contact, informants in two related that their mogha is in the middle of the canal and that only those villagers served by moghas located toward the tail of a minor canal must contact pansal nawees. In two other villages the moghas originate directly in the main canal; therefore, a pansal nawees is not involved.

In the seven augmented villages, only two have contact with a pansal nawees, one six times and the other twelve times per year. In the first case, villagers make contact because their village is located at the tail of the minor. In the second case, tubewell water is not good and villagers need more canal water for proper mixing. As for the remaining five villages, respondents stated that approaches to a pansal nawees were not made for the following reasons;

1) In one village, proximity to a city makes for such close supervision of the pansal nawees that negotiation for concessions is impossible;
2) Another village's mogha is located on a major canal--there is no pansal nawees with which to deal;

3) Two villages are positioned on the upper portion of the minor canal and informants claimed villages to have no need to contact a pansal nawees;
4) In the remaining village, two tubewells provide water of such quantity and quality to make up water deficiencies and reduce pressures to contact pansal nawees.

Pansals Nawees are rewarded in kind, such as a fixed amount of wheat per household according to the farmer's acreage. The average payment for concessions is forty pounds of wheat per square of land.

Overseer

Defects in the mogha generate a need for farmers to periodically deal with the Overseer. The interaction between him and village farmers is primarily collective in nature. Mogha defects, informants said, are sometimes intentionally created. Unauthorized altering of a mogha is a legal offense; a fine can be imposed or a farmer's water turn can be terminated for a period of time. But this has never happened in any of the villages studied. A handsome reward amounting to Rs. 1,000/- is paid to the Overseer by all farmers sharing a common mogha to get necessary repairs done. When a new mogha was to be fixed in one augmented village the overseer had to be "tipped." The amount of such tips varies but in one case the amount was approximately Rs. 2,000/-. This sum represented a collective contribution by the khala members deposited with a village representative.

In one of the sample villages where the tubewell water is too saline for irrigation, the overseer has been approached once during each crop season with a request that he widen the size of the village's two moghas. An amount of Rs. 1000/- was given to him for each mogha enlargement. In another augmented village, a big landlord gave the overseer enough wheat for his family every year in return for permission making it possible for villagers to graze their cattle along the canal sides.

Public Tubewell Operator

This official is relevant to augmented watercourses only. Tubewell operators may choose to place a burden on farmers by not operating a full pumping period. Frequently, the excuse is that there is a power shutdown. Decisions of pansal nawees may make up deficiencies. Where tubewell water is relatively saline farmers on augmented watercourses intensify their bargaining with pansal nawees. The frequency of farmer visits ranges from six to twenty-four times a year, and it increases with farm distance from the tubewell and with farm distance from the mogha. The most common rewards for public tubewell operators are payments in kind--for example wheat for the operator's family and fodder for his cattle.

In sum, then, lower echelon irrigation authorities frequently provide alternative means to cover water deficiencies resulting from improper watercourse cleaning and from missing turns due to a pacca warabundi system. Officials are paid the

required "fees" for rebates in revenues, repair of moghas and reports of "short" water. The interesting thing is that farmers consider that "fairness" in dealings with an official to be a favor in itself. Officials are rewarded for arranging water supply according to the prescribed schedule, for not damaging moghas, for punctuality in the operation of tubewells, and for correct assessment of losses due to shortage of water. Where further "concessions" are given the rates of "fee payment" are much higher. Such concessions are usually given with caution to only a selected number of farmers, who are intimately known to the official concerned.

Conclusions and Suggested Hypotheses

This paper has reported a study of fifteen randomly selected Punjabi villages, seven of which have their canal water supplies augmented by public tubewells. Given the small sample and the need to explore a sizable number of variables due to the lack of systematic laterature on the topic, any conclusions must be highly tentative. The objective of this initial inquiry has not been to test hypotheses but to explore sociological variables with the intention of formulating hypotheses about farmer water management patterns. Based on the observations reported in the foregoing sections, the following hypotheses can be formulated:

H_1: Single or multi-caste villages will mobilize more collective effort for improving water management than will double caste villages. Factionalism and

lack of well defined leadership are not related to any specific caste, but they appear to be associated with the balance of power between castes. Leadership for collective effort can more easily emerge in single agricultural caste villages where caste boundaries need not be crossed, or in multicaste villages where no single caste group can successfully dominant and several groups must bargain and make trade-offs with each other. It is hypothesized that double caste villages tend more to factionalism and polarized conflict making cooperative collective effort less probable and less sustainable.

$H_{1.1}$: Villages falling into the categories of single or multiple caste units, will reveal a greater propensity to generate organized active panchayats which exert leadership in collective water management enterprise, e.g., watercourse cleaning, realignment, and repair.

H_2: The more the number of households sharing a watercourse, the poorer will be the quality of collective water management decision-making.

H_3: Villagers located toward the tail of watercourses contribute more effort to cleaning than do those toward the head. Farmers toward the tail of a watercourse receive less quantity of water because of poor watercourse design and maintenance.

H_4: Farmers toward the tail of a watercourse seek to interact with irrigation officials to make up water losses more than those toward the head. This is posited to hold if the variable of landholding size is controlled.

$H_{4.1}$: The greater the distance a village is located from a mogha or the head of a minor canal from which its moghas draw water, the greater the frequency and intensity of interaction between villagers and the irrigation authorities. The size of village landlords must be controlled in studying this hypothesis.

$H_{4.2}$: The less a watercourse is supplemented by tubewell water, the more the frequency and intensity of interaction between farmers and the four types of lower level irrigation officials.

$H_{4.3}$: The less the quality of tubewell water, the greater the frequency and intensity of interaction between farmers and the four tupes of lower level irrigation officials.

$H_{4.4}$: Villagers located toward the tail of watercourses are more likely to support collective leadership arrangements in the villages than those toward the mogha.

H_5: The greater the differential between the smallest and largest landowners who actually work the land, the greater the pressure for switching from kacha to pacca warabundi.

$H_{5.1}$: The greater the differential between the smallest and largest landowners who actually work the land, the greater the success in accomplishing the switchover from kacha to pacca warabundi if there is more than one large landlord (50 acres or more). Misuse of kacha warabundi in terms of taking more than one's fair share of water is more frequently practiced by large landowners. The switchover to pacca warabundi is wanted more by smaller land owners--yet such smaller operators must obtain support of a larger landlord if they are to successfully deal with the government bureaucracy and courts to effect the change.

$H_{5.2}$: The longer the watercourse, the greater the pressure for pacca warabundi.

$H_{5.3}$: The greater the number of large landowners toward the mogha, the poorer will be the quality of collective watercourse activities.

H_6: The irrigation bureaucracy is more aware of, and responsive to, the water problems in villages which are large landlord dominated as compared to those inhabited entirely by small farmers. The larger the landlords, the more responsive is the bureaucracy as measured by time required to change from kacha to pacca warabundi, and by the willingness of irrigation officials to grant "concessions."

H_7: The presence of public tubewells on a watercourse increases the need for cleaning and maintenance but simultaneously reduces effort devoted to these tasks. There is evidence that the greater amount of water made available by tubewells reduces collective cooperative effort to maintain and clean the common property resource which the watercourse represents.

Bibliography

Adams, John, and U. J. Woltmade
1970 "Village economy in traditional India: a simplified model." Human Organization 29(Spring):49-56.

Blunt, Sir E. A. H.
1931 The Caste System of Northern India. Oxford University Pres..

Boissevain, Jeremy
1960 "Factions, parties, and politics in a Maltese village." American Anthropologist 66(December): 1275-1287.

Corey, Gilbert L., and Wayne Clyma
1973 Improving Farm Water Management in Pakistan. Islamabad: Colorado State University Water Management Research Program. Field Report No. 1 (June): 10.

Darling, Sir Malcolm
1947 The Punjab Peasant in Prosperity and Debt. Geoffrey Cumberlege: Oxford University Press.

Dube, S. C.
1967 Indian Village. New York: Harper and Row Publishers.

Eglar, Zekiya
1960 A Punjabi Village in Pakistan. New York: Columbia University Press.

Eldersveld, Samuel J., V. Jagganadham, and A. P. Barnabas
1968 The Citizen and the Administrator in a Developing Democracy. Scott, Foresman and Company.

Gibb, Sir Alexander and Partners
1966 "Watercourse studies." Programme for Development of Irrigation and Agriculture in West Pakistan. Comprehensive Report 10(Annexure 14). London: Hunting Technical Services Limited.

Gough, E. Kathleen
1955 "The social structure of a Tanjore village." In McKim Marriott (ed.), Village India: Studies in Little Communities. Chicago: University of Chicago Press.

Janowitz, Morris, Deil Wright, and William Delany
1958 Public Administration and the Public: Perspectives Toward Government in a Metropolitan Community. Ann Arbor, Michigan: Institute of Public Administration, University of Michigan.

Jogleker, D. V.
1965 Irrigation Research in India. New Delhi: Central Board of Irrigation and Power. 56. Reidinger cites these figures, op. cit., 85.

Korson, J. Henry
1969 "Student attitudes toward mate selection in a Muslim society: Pakistan." Journal of Marriage and the Family 31(February):153-165.

Lasswell, Harold D.
1931 "Faction." In Encyclopedia of Social Sciences. New York: The Macmillan Company.

Lewis, Oscar
1951 Life in a Mexican Village: Tepoztlan Re-Studied. Urbana, Illinois: University of Illinois Press.

1958 Village Life in Northern India. Urbana, Illinois: University of Illinois Press.

Lieftinck, Pieter, A. Robert Sadove, and Thomas C. Creghe
1968 Water and Power Resources of West Pakistan. World Bank Study Group. Baltimore: Johns Hopkins Press.

Olson, Mancur
1971 The Logic of Collective Action: Public Goods and the Theory of Groups. New York: Schocken Books. Rev. Ed.

Oommen, T.K.
1969 "Political leadership in rural India: image and reality." Asian Survey 9(June):515-521.

Reidinger, Richard B.
1974 "Institutional Rationing of Canal Water in Northern India: Conflict Between Traditional Patterns and Modern Needs." Economic Development and Cultural Change 23 (October):79-104.

Singh, Harjindar
1968 Village Leadership: A Case Study of Village Mohali in Punjab. Delhi: Sterling Publishers (Pvt.) Ltd.

Sirivinis, M. N.
1955 "The social system of a Mysore village." In McKim Marriott (ed.), Village India: Studies in Little Communities. Chicago: University of Chicago Press.

Somjee, A. H.
1962 "Groups and individuals in the politics of an Indian village." Asian Survey 2(June):13-18.

Wakil, Parvez A.
1970 "Exploration into the kin-networks of the Punjab society: a preliminary statement." P. 5-16 in Muhammad Fayyaz (ed.), Pakistan Sociological Writings, Volume 1.

Wiser, William M., and Charlotte V. Wiser
1965 Behind Mud Walls: 1930-1960. Berkeley and Los Angeles: University of California Press.