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ORGANIZING FARMERS TO IMPROVE IRRIGATION WATER DELIVERY—THE PROBLEM AND PROSPECTS FOR SOLUTION IN PAKISTAN

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Data from ten districts in the Punjab and Sind reveal that about half of the irrigation water entering poorly constructed and maintained sample watercourses is lost before reaching farmers' fields. This water is not only lost to crop production but also contributes to waterlogging and salinity. One of the most important things which can be done to increase water supplies to farmers' fields, reduce waterlogging and salinity, and increase the productivity of fertilizer, pesticides, and improved seed varieties, is to undertake a programme of watercourse re-construction and maintenance. This article presents data revealing the extent and significance of water losses, discusses options for organizing farmers to undertake and maintain the watercourse improvements, and suggests guidelines for evaluation of organizing efforts.

I. The Problem

The kinds of organizations which people create and maintain for the social control of irrigation water intimately affect the productivity of its use. Attempting to comprehend physical and agronomic problems of irrigation without probing into underlying social organization for irrigation is like attempting to understand deficiencies in plant growth without reference to conditions of climate. When water moves efficiently from rivers, through a network of canals and associated watercourses to plant root zones, it is because people have effectively organized a decision system capable of enforcing technically sound rules for pursuing the collective interest. Defects in the delivery systems of irrigation water are typically associated with deficiencies in organizational relationships, or the lack of organizations.

Pakistan has one of the most extensive integrated irrigation water distribution systems in the world. However, Pakistani farmers are not

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adequately organized to obtain and apply irrigation water to meet the demands of a modernizing agriculture. Organizing farmers to improve on-farm deliveries of irrigation water represents a most significant problem as evidenced by the following facts :

1. World Bank (1976) estimates suggest that, if the provisions for watercourse cleaning and maintenance stated in the Canal and Drainage Act (1873) were fulfilled, farmers on 78,000 watercourses in Pakistan would "save" approximately five million acre feet of water by 1978 without capital inputs. If farmers were to engage in cleaning and maintenance of watercourses until 1982, about MAF could be saved annually at no cost to government. This amount, valued at Rs. 360 ($ 36) per acre foot, would result in annual savings to Pakistan of approximately $ 360,000,000. Farmers *do not* provide minimum levels of watercourse cleaning and maintenance because they do not know the magnitude of their water losses, they do not know how to do the most effective job of cleaning and maintenance, and they are not *organized* to do the job.

2. Watercourse delivery efficiencies are low--overall approximately forty to sixty per cent of the water entering at the outlet mogha will be lost before reaching farmers' fields. Application field losses range upto about 75 per cent and losses per 1000 feet go as high as 66 per cent (see Table 1). Farmers need to organize to improve their watercourses; a few farmers working independently in an unorganized fashion cannot accomplish the necessary improvements.

3. One per cent of water saved at all watercourse outlets would roughly equal "savings" of about one million acre feet of water across the country. Each acre-inch of water saved has an approximate economic value to the farmer of about Rs. 30 (Eckert, et. al., 1975: 8–16). Organizing farmers to improve watercourses produces immediate and tangible benefits for both the farm and the nation.

Table 1. *Mean Delivery Efficiency and Percentage Loss Rate Summary by Watercourses and by Districts.*

District	location	No. of cases	Weighted mean percentage delivery efficiency	Percentage loss rate/ 1000 ft.	District means weighted by No. of cases in sample
Muzaffargarh					47
WC	1	11	37	32	
WC	2	24	51	24	
Bahawalpur					66
WC	1	13	82	36	
WC	2	19	65	63	
WC	3	11	59	35	
WC	4	11	58	37	
Dadu					60
WC	1	12	44	21	
WC	2	11	65	17	
WC	3	21	66	8	
Thar Parker					54
WC	1	17	59	10	
WC	2	16	63	22	
WC	3	14	40	63	
Thatta					30
WC	1	9	31	47	
WC	2	9	26	24	
WC	3	3	28	35	
WC	4	4	36	107	
Faisalabad					69
WC	1 & 2	63	69	8	
Multan					58
WC	1	7	64	14	
WC	2–4	70	57	15	
Lahore					62
WC	1	10	62	20	
Sargodha					55
WC	1	5	49	18	
WC	2	7	47	18	
WC	3	7	56	13	
WC	4	13	60	10	
Gujranwala					58
WC	1–2	19	58	11	
Total cases		406			

Mean Delivery Efficiency (Ed) = 52.1
Mean % Loss/1000 feet = 28.3

II. An Example

Some of the most significant evidence to support what farmers can do, given incentives, extension education, and engineering assistance, comes from a research programme which has culminated in improvements of watercourses by farmers under the direction of Mona Reclamation Management Experimental Project and the Colorado State University Water Management Research Project in Pakistan.[1] Farmers rebuilt over 33,000 feet of watercourses in 44 days. Later they individually improved over 10,000 feet of their private sub branches. Overall this improvement was accomplished at a cost of about Rs. 2.0 per foot.[2]

This experience, and others, indicates clearly that farmers can be motivated to improve their watercourses at low cost. There are many indications that a well conceived programme can result in a "Watercourse improvement revolution" in the 78,000 watercourse commands in the Indus Basin. However, this will require government incentives and minimum assistance.

What are some of the factors which can be expected to affect the ability of farmers to organize to provide themselves with improved watercourses? Selected factors, pulled from studies to date (Mirza, 1975; Lowdermilk, *et al.*, 1975; Early, *et al.*, 1976), can be presented in hypotheses form. Some are :

1. Leadership for collective action 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 dominate and several groups must bargain in order to make trade-offs with each other. Single or multiple agricultural caste villages, as contrasted with double agricultural caste villages, will reveal a greater propensity to generate organized action and effective leadership in collective watercourse reconstruction, cleaning, and maintenance.

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1 The Colorado State University Water Management Research Field Team in Pakistan is involved in testing various approaches to the problem of improving watercourses with farmers' cooperation. These field experiments are expected to provide guidelines which can be incorporated in larger scale improvement programmes.

2 See : Colorado State University Field Party and Mona Reclamation and Experimental Project, "Helping Farmers Identify and Achieve Their Potential for Watercourse Improvement." Mimeographed report available at CSU water Management Research Project Office, Islamabad, 1976. (The estimated cost includes farmers' labor, permanent structures, engineers' and extension workers' time plus about Rs. 10,000 in experiments by CSU. Therefore the actual cost should be less than Rs. 2.0 per foot of improved watercourse.)

2. The greater the number of households sharing a watercourse command area, the greater the difficulty in mobilizing collective action to improve water management.
3. Farmers at the tail of the watercourse reveal a greater propensity to mobilize for action to reconstruct, clean and maintain the watercourse than farmers whose land is located near the head of the watercourse.
4. The greater the number of large landlords toward the mogha (head of watercourse), the poorer the quality of collective watercourse activities.
5. The presence of public tubewells, providing supplemental water, on a watercourse leads to reduced efforts of farmers for reconstruction, cleaning and maintenance.

Such hypotheses can be further tested in evaluations of farmers water user associations.

III. Options For Organizing Farmers

In order to reconstruct and maintain improved/watercourses, local farmer water users associations would function to :

a. Organize construction of improved watercourse
b. Provide for watercourse operation and maintenance including silt and vegetation removal and the hiring of a local chowkidar.
c. Manage conflict pertaining to the watercourse and water allocation.

The question is, how might water user association be established in Pakistan? There appear to be three primary legal alternatives in the absence of specific legislation providing the purpose and guidelines for formation of such organizations.

Alternative 1—Informal Water User Associations

The informal approach is conceived as a minimum solution. It may be preparatory for becoming a formal organization when the membership has gained sufficient experience and maturity. In this farmers would be allowed to work out their own organization procedures fitting their particular situation. A variety of approaches will most likely evolve and all should be carefully evaluated.

Alternative 2—Organizing Farmers Formally Under the Companies Act (1913)

A "company" is defined by its common usage as "an association of a number of individuals formed for some common purpose" (Radosevich and Kirkwood, 1975; 92-93). Section 4 (2) of the Companies Act provides that no company, association, or partnership consisting of more than twenty persons shall be formed for the purpose of carrying on any function (except banking) that has as its object the acquisition of gain unless it is registered as a company under the Campanies Act or other act or charter. This provision does enable the voluntary formation of water user association, since entities are not created for gain or profit, but rather to help the users in optimizing their total resource capabilities.

An association which has organized under the Act may issue shares representing ownership interest. The ownership interest can be represented by irrigated acreage within the canal delivery area, capital contributions, or other selected criteria. These shares are transferable and become, in effect, "movable property."

Shares in the association can be appurtenant to the land, transfer may be made from owner to purchaser upon sale of land or from landlord to tenant upon change of working parties, but should not permanently be transfered from the parcel of land. This protects lands from being taken out of production due to the sale of water rights.

Alternative 3—Organizing Farmers Formally Under the Cooperative Societies Act (1925)

The Cooperative Societies Act, 1925 (Radosevich and Kirkwood, 1975: 94-96) was enacted to facilitate the formation and working of cooperative societies for the promotion of thrift, self-help, and mutual aid among agriculturists and other persons with common economic needs so as to bring about better living, better business and better methods of production. It was made applicable to the whole of Pakistan, except in Tribal Areas, by the Sind Cooperative Societies (West Pakistan Amendment) Ordinance, 1965.

Only societies registered as cooperatives may use the word "Cooperative" in their titles. The Provincial Government may, by special order exempt any society from registration requirements in an effort to save trouble. Provisions of the companies act do not apply to societies registered under the Cooperative Societies Act; this simplifies administration.

IV. Establishing Organizational Boundries

One important feature which distinguishes the formation of water user associations is the boundary of the organization. Association boundaries must have a logical relationship to the water delivery, use and drainage area. Thus, they can be organized around a watercourse, one or more villages receiving water from a common canal, or some other configuration having a common source of supply (see Figure 1 for illustration).

Quite often water users within an irrigation system find it not only beneficial to organize at the association level, but also to create a federation of associations along the minor and/or major canals (Radosvich, 1975: 16–22). Figure 2 illustrates one possible arrangement.

V. Evaluating Proposed Alternatives

Systematic evaluation should be undertaken to obtain empirical data regarding the problems and successes of organizations operating under these three alternative conditions. Selected principles for conducting the evaluative research might be as follows :

1. Research should not evaluate specific administrators or village leaders—it should be primarily designed to evaluate the outcomes of alternative *policies* and *organizational* frameworks.

2. Researchers and associated administrators should emphasize the importance of the problem—obtaining and developing effective farmer water users associations—rather than emphasizing any specific method of obtaining effective farmer organizations. Should any single model fail, it is essential to be in a position to shift to alternative models.

3. Affected administrators and villagers should be involved in the programme evaluations as much as possible while still protecting the integrity of the assessment and evaluation.

4. Given that field conditions prohibit full implementation of tight experimental design in which *all* potentially confounding variables can be controlled, quasi-experimental designs are suggested. Lack of control over all potentially confounding variables is not cause for despair or paralysis, but researchers must generate, as many

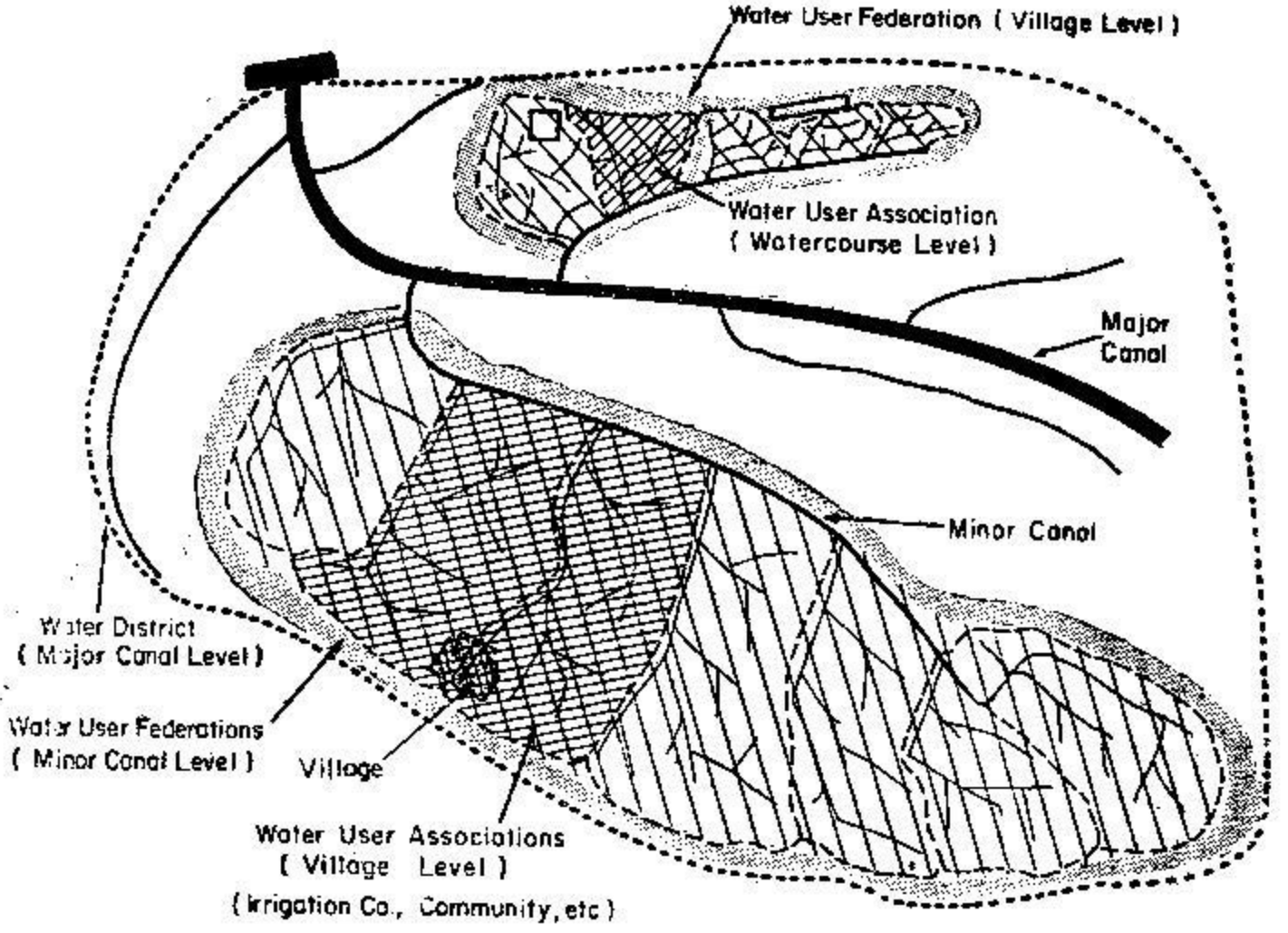

Figure 1. Water User Organizations for Pakistan: Development Scheme.

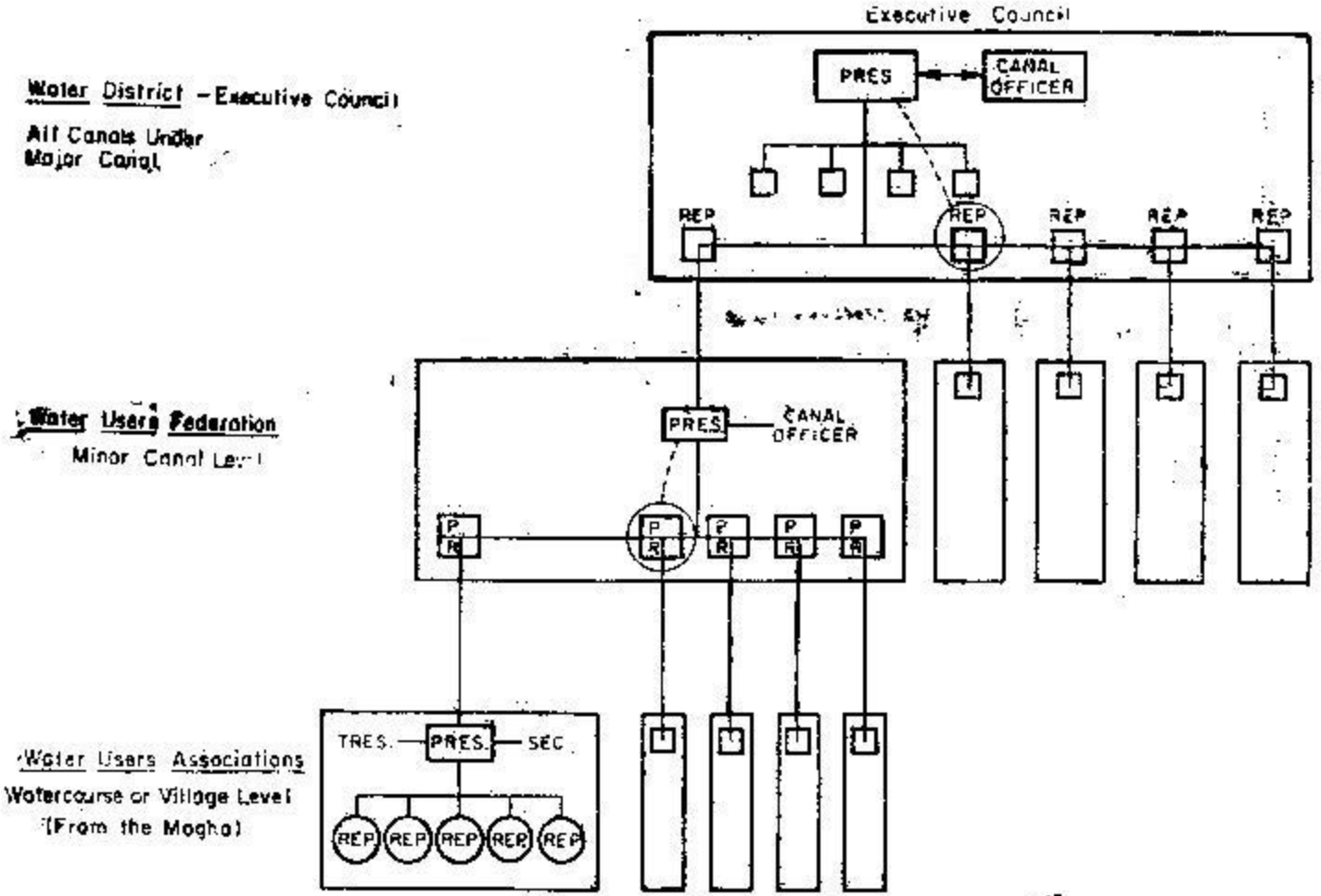

Figure 2. Water User Organization for Pakistan Organization Scheme

plausible rival hypotheses as possible and do supplementary research which will determine whether the rival hypothesis can explain programme "successes" or "failures".

VI. Summary and Conclusions

This paper has made a case that water losses of major magnitude are occurring due to poorly constructed watercourses that such losses can be reduced in major ways at great savings to the national economy, and that to accomplish the objective of improving watercourses, farmers must be organized to effectively provide themselves with an important collective good—a well-designed, well constructed watercourse which will reduce seepage damage at the head of the channel, and which will increase needed water supplies at the tail.

At present, three organizational alternatives are available for establishing the necessary water users associations—the informal, the authority of the Companies Act, and the authority of the Cooperatives Act. Farmers may elect to organize in any of the three ways, but it is essential to carefully evaluate the outcomes of their efforts before major policy commitments are made.

One of the most important constraints to increasing agricultural production is the limited water supply. The productivity of improved seeds and fertilizers which have constituted much of the "green revolution" is centrally dependent upon adequate supplies of irrigation water. Given an inadequate supply of irrigation 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. Fertilizer is relatively costly and return from its application depends on the delivery of water in adequate amounts and at the proper time. 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 most rational response, but one which sacrifices productivity. One of the most important things that can be done to increase water supplies, as well as to reduce water logging and salinity, is to reconstruct poor watercourses which, overall, lose over fifty per cent of the water between the mogha and the field outlet. But to reconstruct watercourses and to maintain the improvements, farmers must be organized. This paper has addressed some of the major considerations relevant to that organizing effort.

REFERENCES

Canal and *Drainage Laws, 1873: As Amended Up to Date, Revised* Edition. n.d, Compiled by S. Masud-ul-Hussan. Lahore, Khyber Law Publishers. Secont Edition.

Early, Alan C., Max K. Lowdermilk, and David M. Freeman, *Physical, Social and Economic Factors Affecting Irrigation Behaviours on Punjabi Watercourses.* Wate Management Technical Report No. 45. Fort Collins, Colorado: Colorado State University, 1975.

Eckert, Jerry, Niel Dimick, and Wayne Clyma, *Water Management Alternatives for Pakistan. A Tentative Appraisal.* Water Management Technical Report No. 43. Fort Collins, Colorado: Colorado State University, 1975.

Lowdermilk, Max K., Wayne Clyma, and Alan C. Early, *Physical and Socio-Economic Dynamics of Watercourse Improvement in Pakistan's Punjab: System Constraints and Farmer's Responses.* Water Management Technical Report No. 42. Fort Collins, Colorado: Colorado State University, 1975.

Mirza, Ashfaq Hussain, *A Study of Village Organizational Factors Affecting Water Management Decision Making in Pakistan.* Water Management Technical Report No. 34. Fort Collins, Colorado: Colorado State University, 1975.

Radosevich, Georage E. and Craig Kirkwood, *Organizational Alternatives to Improve On-Farm Water Management in Pakistan.* Water Management Technical Report No. 36, Fort Collins, Colorado: Colorado State University, June 1975.

Radosevich, George E. and Dennis Stickley, *Water Laws and Institutions in Pakistan.* Colorado State University, (in Press, Publication date late 1976).

Radosevich, George, *Water User Organizations for Improving Irrigated Agriculture : Application to Pakistan*. Water Management Technical Report No. 44; Fort Collins, Colorado: Colorado State University, Dec. 1975.

World Bank, *Pakistan Special Agricultural Sector Review*. Volume III Annex. on Water Management, January 28, 1976.