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Factors Influencing the Irrigators' Organization in India

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Abstract

Irrigators' participation in the project management of surface irrigation systems in the Indian context is influenced by many factors. Important among them are the irrigators' confidence in the systems' mode of delivery of water supplies and their self-perceived ability to share responsibilities with the irrigation bureaucracy. A discriminant analysis of some select variables is undertaken and it is found that the model developed has a fairly high predictive value for decision-makers with regard to formation of irrigators' organizations.

THE PARTICIPATORY ROLE of irrigators in the running of irrigation systems in India has been negligible. This has caused great concern among the planners who have drawn up an ambitious programme for bringing approximately 50 per cent of the net cultivable area under irrigation by the end of the current century (Panday, 1980). Intensive involvement of the irrigators would enable the mobilization of local resources so that at least some major part of annual operational as well as capital investment costs of the irrigation projects could be recovered. Furthermore it would help tap the hitherto neglected talents of the farmers — such as their knowledge of the local environment and skills in the management of natural resources at the decentralized level (Agricultural Development Council, 1980).

The objective of this paper is to explore the factors influencing the irrigators' coming together to share responsibilities with the irrigation bureaucracy. The paper is divided into three sections. The first presents a brief background to the problem of a

lack of farmers' participation in irrigation projects in India. The second section describes the analytic strategy adopted for this study and the third section presents the results of the empirical analysis, drawing certain conclusions.

A Background to Irrigation in India

Irrigation departments in the Indian States have the responsibility of operating and maintaining the main system. This consists of the head works, canals, branches and distributaries leading to the Government outlets of generally one cusec psl/sec capacity serving about 40 hectares. Irrigators are expected to maintain the conveyance system below the Government outlet, consisting of field channels for taking water to the individual fields, community-oriented structures like division boxes, siphons and road crossings, and field drains for removing excess water — all of which have been constructed by the Command Area Development Authorities (CADAs) on behalf of the farmers at the latter's cost (Jayaraman and Clyma, 1981). The irrigators are also expected to regulate the distribution of water supplied among themselves. However, past experience has been that the pious expressions of farmers voluntarily coming together and establishing an association to take up the tasks of collective maintenance and distribution of water supplies have largely remained on paper, as project management lacks credibility. Due to the absence of certainty, and adequacy and controllability of the water supplies at the outlet head, the irrigators were scrambling for water for their fields all the time, with no-one getting adequate supplies at any time. Furthermore, they were showing no interest in maintaining field channels and structures, as they felt no significant advantage in doing so. The resultant situation was one of distrust and lack of enthusiasm on the part of the irrigators to come together to carry out the generally expected community maintenance works. On the other hand, the irrigation bureaucracy had no convincing case for organizing the farmers, especially when their own position was weak due to the inefficient operation of the system, which resulted in invariably doubtful discharge compounded by uncertainty in availability at the outlet heads.

Various international researchers and funding agencies have attributed such an inefficient level of operation of irrigation systems to the lack of institutional developments and the absence of extension efforts (Colombo *et al.* 1977; Pereira *et al.* 1979) and to the presence of a certain unique hierarchy of social relationships among the farmers (The World Bank, 1978). But this is only partly true. The empirical evidence from Gujarat State, which is well known for co-operative credit and primary processing societies, has shown that unless confidence in irrigation supplies is established, the irrigators do not feel motivated for any group action at the outlet level (Jayaraman, 1981a).

One way to create confidence in irrigation supplies is to introduce rotational water supply (RWS). Under RWS, each farmland in the command area of the outlet is assured of water, regardless of its physical location and the economic position of the owner — for example, a large- or small-scale farmer, or a social situation such as belonging to a low or a high caste. Taking into account the available quantum of water, the prevalent cropping pattern and the total water requirements based on the agronomic studies for each crop with due consideration to soil properties and the intervals at which irrigation has to be administered, detailed schedules of water delivery on a hectare/time basis for each piece of land are prepared. Additional time is allowed for lands situated in the

middle and tail-end of the outlet to adjust for travel time and transmission losses. Thus, a farmland of a given area in the tail-end would be allotted more time than one of identical area in the upper reaches. These schedules — fixing days of the week and times for each farmland along with the name of its owner — are displayed on the board fixed at the head of the outlet for all irrigators to see. Thus, they come to know their time of supply and exercise their water rights by taking turns. An evaluation study revealed that the RWS had created an extremely favourable impact, mainly because of the assured supply of water at predetermined intervals in accordance with soil/crop/water requirements. The gains were considerable. The irrigators could plan their crops and procure the needed inputs under conditions of certainty, adequacy and reliability of irrigation. Furthermore, as their turns were fixed, they could allot their time more usefully, saving much time and energy previously spent in waiting and scrambling for water supplies, which had often resulted in frustration and conflicts with fellow irrigators (Jayaraman, 1981b).

Introduction of RWS required certain physical improvements such as control structures, measuring devices at appropriate places in the main system as well as at each of the outlet heads, and lining of the initial distance of the earthen channels from the outlets. But critically important was the careful scheduling of water distribution based on crop/soil/water requirements and the farmers' observance of schedules. The latter are generally known as software applications in contrast to the hardware components of physical improvements (Levine, 1977). Special efforts have now been undertaken to introduce RWS in many of the irrigation projects in India.

A survey of attitudes of farmers in the command area (221.36 ha) of Rawalapura Minor (278.12 l/sec) in the Mahi-Kadana Irrigation Project in Gujarat State, India, where RWS was in vogue for a period of three years (1978-81), shows that out of 216 irrigators, 170 preferred to form an organization to carry out the minimal functions such as maintenance of field channels and overseeing the observance of RWS schedules; 46 irrigators expressed themselves against forming any organization (Jayaraman, 1982). Thus, it is apparent that, besides assured supply of irrigation, there are other factors at work influencing the farmers' preference for or against formation of an irrigators' organization. The following section explores these factors.

Analytic Strategy

The selection of factors governing the preference for or against an irrigators' organization in an irrigation project has to be based on our limited understanding of the Indian irrigators' behaviour, since the literature available on the subject is negligible. As in the case of economic behaviour of the Indian farmer, the land-holding size would be an important element in their attitudes towards organization. It is generally held that the larger the size of a holding, the bigger the sphere of influence, since the farmer would be able to command respect among fellow farmers and attention from Government officials.

Similarly, the age of the irrigator could also be considered a key factor, since in these traditional societies old people are given respect and listened to in the settlement of village conflicts. They also mould public opinion and take pride in taking up and discharging public responsibilities. However, assimilation of new ideas and willingness to experiment with them are highly correlated with education. The approach of a farmer with no formal education to the challenging problems of a collective nature is largely

timid and conservative compared to that of farmers who have spent some years acquiring education of a high-school or college standard.

While land and age are measurable variables, in hectares and years respectively, the level of education is a categorical variable. The variable assumes the values of 0 if the irrigator concerned did not have any formal education; the value of 1 if he had education up to primary level; the value of 2 if he had been to a secondary school; and the value of 3 if he had been to college. The three variables would constitute the socio-economic background.

Two variables governing the physical availability of water deserve consideration. They are the location of the farmer's field in a given outlet command and his acceptance of the new method of disciplined water distribution under the RWS scheme. As regards the geographical location, the farmer placed at the tail-end of the outlet normally feels let down, as his access to water supplies is generally less than that of the farmer who is at the upper reach of the command area and hence closer to the outlet. This is especially so under the traditional pattern of supplies without the rotational system. To determine the farmer's location in a given outlet command, the distance from the outlet head to the farthest point in the command area is divided into three equal parts. The farmers placed in the initial section are designated as belonging to the upper reaches, those in the central part as belonging to the middle reaches and those in the final part as tail-enders. As physical location is a categorical variable, it assumes the value of 0 if the farmer belongs to the tail-end; the value of 1 if he is in the middle part; and the value of 2 if he is in the upper reaches.

The next variable is the irrigators' acceptance of RWS, which involves certain discipline. Though a farmer may be assured of water in predetermined quantities on an appointed weekday and at a fixed time, he might feel as if he were in a strait-jacket with no freedom to manoeuvre. He might also have an alternative in mind and in that case he might be dissatisfied with the scheme of RWS. The variable assumes the value of 0 if the irrigator feels that he is not satisfied with RWS and the value of 1 if he is satisfied.

In addition to the irrigator's satisfaction with obtaining an assured supply of water under RWS, his own perception of his rights being protected if he were to become a member of an organization is an important variable. Presently, by subjecting himself to the discipline of taking water only according to a predetermined schedule of RWS, he surrenders some of his individual sovereignty in the larger interest. Apparently, he may miss the freedom of taking water any time he pleases; however, by binding himself to a code of conduct, not only does he ensure his own right to water, but he also protects the rights of others without conflict of any kind. His mental perception of protecting such a right is clearly a determinant in preferring an organization of irrigators. The variable assumes the value 0 if the irrigator feels that his right to water would not be protected and the value of 1 if he feels otherwise.

The next variable is his readiness to take up responsibilities involved in an organization. This is reflected in his preparedness to regulate water distribution below the outlet and to assume certain minimum functions concomitant to such self-regulation. If the irrigator feels that he is unable to self-regulate, the variable takes the value of 0; if he feels that he is able to self-regulate, the variable assumes the value of 1. The last two variables thus reflect the irrigator's willingness for community action.

The attitude towards organization, either for or against, is the dichotomy separating the group of irrigators preferring to form an organization from the other group of irrigators who are clearly against such a move. With the help of discriminant function analysis, the two groups of irrigators can be separated. Such an analysis of various socio-economic characteristics can profitably be used for future planning by decision-makers, if the model is found to emerge with a high predictive value.

The linear discriminant function of the following formula is employed to

discriminate the socio-economic characteristics of the two groups of farmers:

$$Z = \sum_{k=1}^{n} a_k X_k$$

where: Z = total discriminant score for the irrigator who is for an association and for the irrigator who is against such an association;
X_1 = size of land holding in hectares;
X_2 = age in number of years;
X_3 = 0, if the irrigator is illiterate
1, if the irrigator has attended primary school
2, if the irrigator has attended secondary school
3, if the irrigator has attended a college;
X_4 = 0, if the irrigator is located at the tail-end
1, if the irrigator is located at the middle
2, if the irrigator is located at the upper reaches;
X_5 = 0, if the irrigator is not satisfied with RWS
1, if the irrigator is satisfied with RWS;
X_6 = 0, if the irrigator is not prepared to self-regulate
1, if the irrigator is prepared to self-regulate;
X_7 = 0, if the irrigator feels that his right to water would not be protected
1, if the irrigator feels that his right to water would be protected.

Results of Empirical Analysis

The study sample consisted of 305 irrigators in the command area of Rawalapura Minor. Out of this total, 216 responded to an interview-cum-questionnaire method of inquiry in all completeness, covering the seven variables (X_1-X_7) listed previously.

Out of 216, 170 irrigators opted for an organization of some sort ranging from an informal association to a statutory co-operative society; 46 irrigators did not favour formation of any organization. None of the respondents belonged to the backward caste group of Harijans, who have been scheduled as the lowest caste group in the Hindu caste hierarchy, thus meriting special consideration for facilities on concessional terms. Table 1 presents the means and standard deviations of the independent variables for the two groups of irrigators. Statistical 't' tests for determining whether there is any significant difference between the two groups' means for each variable were conducted. The tests show the absence of any significance between the two groups' means in regard to four variables — namely, area, age, education and protection of rights. But, in regard to three variables — namely, location, satisfaction with RWS and ability to self-regulate — there is a high degree of statistical significance between the two groups' means. Thus, on the basis of this analysis, one can conclude that an irrigator, if he is favourably located in the outlet command — such as in the upper reaches or at least in the middle, rather than at the tail-end — given other things, is more likely to opt for an organization. Similarly, satisfaction with RWS and self-reliance for regulating supplies are also significant factors influencing the formation of an organization.

However, when the entire set of study variables is entered into an analysis, without rejecting any of them for measuring the characteristics on which the groups

TABLE 1
MEANS AND STANDARD DEVIATIONS OF VARIABLES: COMPARISON OF TWO GROUPS

	Irrigators in favour of Organization ($n = 170$)		Irrigators against Organization ($n = 46$)		
Variables	Mean	S.D.	Mean	S.D.	't' Statistic
Area (ha)	0.59	0.63	0.56	0.51	0.1127
Age (years)	48.69	13.96	48.11	12.78	0.0716
Education	1.18	0.71	1.17	0.71	0.0072
No Education = 0					
Primary = 1					
Secondary = 2					
College = 3					
Location	1.04	0.79	0.80	0.69	4.1081*
Tail = 0					
Middle = 1					
Upper = 2					
Satisfaction with RWS	0.96	0.19	0.85	0.36	3.9934*
No = 0					
Yes = 1					
Ability to self-regulate	0.88	0.32	0.48	0.51	25.5726*
No = 0					
Yes = 1					
Protection of rights	0.93	0.26	0.87	0.34	1.2368
No = 0					
Yes = 1					

*Significant at 0.05% level.

are expected to differ, we have to resort to discriminant analysis. Table 2 presents the results of discriminant analysis, reporting the values of discriminant weights for the seven variables that were entered for determining the discriminant function. Of these seven variables, three have negative signs and four, positive. Of the three variables having negative signs, we find that the magnitudes of weights of area and education are low. Among the variables with positive signs, we find that the weight of the variable relating to the ability to self-regulate has a relatively high value. The tests of significance, both the F ratio and the Bartlett's Chi-squared Test, show that the discriminant function determined by entertaining the seven variables is statistically highly significant. Hence, the null hypothesis of equality of group centroids (means) is rejected. Table 3 presents the means of the two groups' discriminant scores. The cutoff point for discriminating between the two groups of irrigators (one for an organization and the other against) is arrived at by taking the simple mean of the two groups' mean discriminant scores. On the basis of the cutoff point, the predicted classification of the irrigators as against the actual classification into two groups is shown in Table 4. It is interesting to note that the classification matrix suggests that (151 + 24)/216 or 81 per cent of the sample is correctly classified. Hence, the separation effected by the discriminant function is also fairly satisfactory from the practical point of view.

TABLE 2
RESULTS OF DISCRIMINANT ANALYSIS

Variables		Discriminant Weights
Area		0.0118
Age		— 0.0001
Education		— 0.0058
Location		0.0265
Level of satisfaction with RWS		0.0163
Ability to self-regulate		0.1830
Protection of rights		— 0.0440
Mahalanobis D^2	1.3557	
F(7,208)	6.8150	
Bartlett's Chi squared Test: (Degrees of Freedom: 7)	43.4655	

TABLE 3
DISCRIMINANT SCORE MEANS AND CUTOFF POINT

Group Number	Sample Size	Mean
For organization	170	0.1586
Against organization	46	0.0796
Cutoff point (0.1586 + 0.0796)/2 = 0.1191		

TABLE 4
CLASSIFICATION MATRIX OF IRRIGATORS

		Predicted by Function		
		For Organization	Against Organization	Total
Actual	For organization	151	19	170
	Against organization	22	24	46
	Total	173	43	216

Conclusions

This paper examines the factors influencing irrigators to form associations for taking up certain minimum functions at the outlet level. These minimum functions would include the maintenance of physical infrastructure, resolution of disputes among irrigators and liaison with the irrigation bureaucracy. Assumption of such functions from the bureaucracy would enable the irrigators to develop individual skills and initiatives towards fulfilling the much-desired objective of participation in running the project operations.

Based upon the limited experience of an existing irrigation project in Gujarat State, India, we find that favourable physical location of the farmer's land, level of satisfaction with rotational water supply (RWS) and confidence to self-regulate supplies at farm level are significant factors in the formation of an irrigators' organization. However, four more variables were added and, in all, seven variables were entered into a discriminant function analysis. Such an analysis was found useful to separate the irrigators into two groups, one for and the other against organization. The conclusions emerging from the study are:

(a) Substantial field research is needed, especially in the area of socio-economic characteristics of the irrigators.
(b) Since there is no current input at the CADA level from the sociologists or economists in this regard, there is a need to strengthen them with appropriate staff assistance.
(c) Alternatively or together with governmental efforts of the kind referred to, universities and research institutions located in various parts of the country could usefully take up action-research with regard to irrigators' participation of a different kind and provide the much-needed research support to the CADAs.

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