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Institutional and Economic Dynamics of Water Users Cooperative (WUC) Societies in Cauvery Basin of Karnataka

B.K. Rohith and M.G. Chandrakanth

Department of Agricultural Economics, University of Agricultural Sciences,
Bangalore - 560 065, Karnataka

Abstract

The economic and institutional dimensions of water users cooperative (WUC) societies have been analyzed with regards to performance, membership and transaction costs in forming organization in the Cauvery basin of Karnataka. Field data have been collected from presidents and members of 30 WUC societies in Tirumakudalu Narasipura taluk of Mysore, Karnataka. Using cluster analysis, these have been grouped into (i) well performing, (ii) moderately performing, and (iii) poorly performing WUC societies. To understand institutional and economic dimensions, the selected WUC societies have been grouped based on command area, membership and conjunctive use of water. The odds ratio determined using logit model has indicated that for every one chance of not willing to pay additional water charges, there are seven chances of willingness to pay. Landholding size of farmer, conjunctive use and distance of the farm from canal have been found to significantly influence his/her willingness to pay for the assured summer irrigation. The mean willingness to pay amount for assured summer canal water has been found as ₹ 178 over and above the existing charge of ₹ 100. With all the odds being faced by these cooperatives, this study has revealed the inner strength of water user cooperative societies in canal water distribution through collective action.

Key words: Water users cooperative society, Institutional economics, Water institutions, Cauvery Basin

JEL Classification: Q13, Q15, Q25, K00

Introduction

A water user cooperative (WUC) society is an organization of water users administered on the principles of cooperation and its role is to implement water institutions, and in the process to achieve a fair water allocation across different locations. Farmers through WUC societies can interact with Irrigation Department / Jala Nigam, Command Area Development Authority (CADA), Departments of Revenue, Agriculture, Cooperation and Rural Development for the efficient use of water with integrated approach (CADA, 2000).

To promote Participatory Irrigation Management (PIM), the Governments of Andhra Pradesh (Nikku, 2002) and Tamil Nadu have enacted 'Andhra Pradesh Farmers Management of Irrigation System Act of 1997' and the 'Tamil Nadu Farmers Management Irrigation System Act of 2000', respectively. However, Karnataka (Government of Karnataka, 2000) has only amended its "Irrigation Act of 1965" to incorporate provisions of PIM. These policy reforms emphasize "Irrigation Management Transfer" from the State Department to Water User Association / Water User Cooperative Society – a paradigm shift from state management to user institutions.

Objectives of Study

The study was conducted with the following objectives:

* Author for correspondence,
Email: rohithecon@gmail.com

- to study institutional and economic dynamics of WUC societies, and
- to identify the factors that influence the willingness to pay additional water charges for assured irrigation during summer season.

Methodology

During the survey of the Krishnaraja sagar (KRS) command area (in 2006-07), it was learnt that the WUC societies in the Tirumakudalu Narasipura taluk have been performing well. In order to study the WUC societies and factors influencing their economic performance, ten per cent of the total WUC societies in the Cauvery basin canal were chosen. This ten per cent, i.e. thirty WUC societies of Tirumakudalu Narasipura taluk in the Krishnarajasagar and Kabini command of Cauvery basin were selected for the study.

To study the institutional and economic dimensions, 30 WUC societies were grouped based on (i) Cluster formation, (ii) Command area, (iii) Membership, and (iv) Conjunctive use of water. Each of the 30 WUC societies was personally visited and information was collected from the President / Secretary of the society using a pre-structured schedule. These societies have a command area ranging from 618 acres to 1,770 acres. The percentage of paddy cultivation in the command area during the summer season was the key variable to quantify the scarcity of water. Societies were supposed to have membership from all the command area farmers in each village. The transaction cost involved in the formation of a WUC society was taken as the time spent by the Promoter / President on motivating the farmers towards formation of a society.

Cluster analysis was used to classify explanatory variables which group together signifying a unified dimension to classify objects of analysis to relatively homogeneous groups called clusters. Objects in each cluster tend to be similar to each other and dissimilar to objects in the other clusters. Set of variables or characteristics representing the objects to be clustered were used to calculate the similarity between objects.

Results and Discussion

Characteristics of Sample WUC Societies

In order to analyze the performance of WUC societies, three societies selected for a micro level study were; Rajaparameshwari WUC Society, Benakanahalli WUC Society and Yariyur WUC Society. Their characteristic features are given in Table 1.

Thirty farmers from each of the three groups of WUC societies were interviewed to know the

Table 1. Characteristics of water user cooperative societies selected for the study in Cauvery basin of Karnataka

Sl. No.	Features of society		WUC societies with good governance	Conjunctive use WUC societies with good governance	WUC societies with poor governance
1	Name of society		Rajaparameshwari WUC Society	Benakanahalli WUC Society	Yariyur WUC Society
2	Command area of society (acres)		1,353	1,525	960
3	One time grant received		Yes	Yes	No
4	Paddy area (%)	*Kharif*	90.77	84.78	100
		Summer	77.14	0.80	23.32
5	Sugarcane area (%)		5.5	14	0
6	Total number of members in the society (Membership percentage)		156 (58.8)	413 (59.0)	120 (34.2)
7	Office / Godown grant received and constructed		Yes (₹ 3 lakh)	Yes (₹ 1.2 lakh)	No
8	Number of farmers in the society		265	700	350
9	Funds in the society per farmer (₹)		1,270	507	34
10	Percent of farmers who attend general body meetings (%)		87	90	65

Source: Rohith (2007)

Table 2. Grouping WUC societies with common societal characteristics using cluster analysis

Sl. No.	Characteristics	Well performing societies (Cluster-I = 6 societies)	Moderately performing societies (Cluster-II= 6 societies)	Poorly performing societies (Cluster -III = 18 societies)
1	Number of villages under the jurisdiction of WUC societies	5	4	3
2	Farmers' cooperation in forming the society [Good cooperation (2), Moderate cooperation (1), Less cooperation (0)] as perceived by the President of WUC society	1.16	1.05	0.66
3	Transaction cost of forming WUC (time spent in formation in months)	3	3	5
4	Percentage of members attending general body meeting (%)	74.4	63.5	51.0
5	Number of years, after signing MOU (Memorandum of understanding)	4 years 8 months	One year and six months	Five years
6	Command area (acres)	1,208	1,263	1,196
7	Total fund available with society (₹)	3,11,081	21,283	21,950
8	Number of WUC members in the command area of WUC	212	212	219
9	Number of farmers in the command area of WUC society	453	596	597
10	Funds in Society per farmer (₹)	785	39	40

Source: Rohith (2007)

performance of WUC societies and find willingness to pay (WTP) additional charges for assured summer irrigation. To assess the willingness to pay for assured summer irrigation, logit and tobit regression functions were used.

Grouping WUC Societies Using Cluster Analysis

The WUC societies were grouped into three clusters with similar characteristics with respect to explanatory variables (Table 2). Considering the strength of different variables responsible for clustering WUC societies, the first cluster had six well performing societies, the second cluster had six moderately performing societies and third cluster had 18 poorly performing societies. The cluster-I was characterized as well performing, since it had the lowest transaction cost of forming the WUC society, the highest farmer's cooperation and the highest fund availability.

The cluster-II (with six WUC societies) was characterized as moderately performing, because it had experienced a transaction cost of three months with fund availability of ₹ 21,283. The cluster-III was classified as poorly performing as it had the largest transaction cost of around five months with low fund availability.

Classification of WUC Societies Based on Command Area

The mean command area of WUC societies considered for the study being 1,210 acres, were classified as 'Below Mean Command Area' (BMCA) and 'Above Mean Command Area' (AMCA) (Hugar, 1997). Fourteen societies were in the BMCA category and 16 were in the AMCA category. There were five villages in BMCA and 4 villages in AMCA. In both BMCA and AMCA, more than 60 per cent of the members attended the general body meeting of WUC societies (Table 3).

Among 595 farmers in the BMCA, 39 per cent had enrolled as members of WUC society, while in AMCA, 52 per cent farmers were members. The smaller command area societies had high farmers cooperation, according to the perception of the president of the society. But, the transaction cost of forming the organization was higher in BMCA societies than AMCA societies. The number of borewells was higher in BMCA (28) compared to AMCA (20). More societies under BMCA had received one-time grant as compared to AMCA societies.

Table 3. Characteristics of WUC societies based on their command area in Cauvery command: 2005

Sl. No.	Characteristics of society	Societies with below mean command area (BMCA) (below 1210 acres) Number of societies =14	Societies with above mean command area (AMCA) (above 1210 acres) Number of societies =16
1	Area under paddy during summer season (%)	35.2	27.3
2	Number of villages under the jurisdiction of each WUC society	5	4
3	Farmers' cooperation in forming the society (0 = Low cooperation, 1 = Moderate cooperation, 2 = High cooperation)	1.21	0.81
4	Transaction cost in forming organization (contribution of time in months)	4.79	3.91
5	Percentage of membership (%)	39	52
6	Percentage of members who attended the general body meeting (%)	62.7	63.5
7	Number of farmers in the societies area	595	545
8	Total fund available with the society per farmer (₹)	167	208
9	Number of borewells in the command area (No.)	28	20
10	Percentage of societies received one time grant (%)	25	14

Source: Rohith (2007)

Classification of WUC Societies Based on Membership Percentage

Based on the percentage of members enrolled, the thirty WUC societies considered for study were classified into 'Societies with less than 50 per cent membership' (LFM societies) and 'Societies with more than 50 per cent membership' (MFM societies) (Table 4). The percentage of membership among the LFM societies was about 30 per cent, while that of the MFM societies was 54 per cent. In both the LFM and MFM societies, 60 per cent of the registered members attended the general body meeting of the society.

The MFM societies had 75 per cent higher funds per achkatdar than the LFM societies, as 27 per cent of MFM societies had received one-time grant, as compared to 16 per cent in the LFM societies. In the area of LFM societies, farmers had 27 borewells, which were 40 per cent more than the bore-wells in the MFM societies (19 borewells). The LFM societies had grown paddy in 36 per cent of the area as compared to 22 per cent by the MFM societies. The time spent by the promoter of WUC societies was more than 4 months, irrespective of the society and there was not much difference in the transaction cost of forming a WUC society. The farmer's cooperation was lower in LFM than MFM societies. The LFM society had 612 achkatdars as compared to 492 achkatdars in MFM society. The average command area of LFM societies was 1,185 acres, while that of MFM societies was 1,253 acres.

Classification of WUC Societies Based on Conjunctive Use of Water

The WUC societies were classified as low conjunctive water-use (LCWU) societies and high conjunctive water-use (HCWU) societies based on the groundwater irrigation in the command area (Table 5). Considering the average number of borewells in the sample societies as 24, nineteen societies were classified as LCWU, having less than 24 bore-wells in their command and 11 societies were classified as HCWU societies, having more than 24 bore-wells in their command area.

The conjunctive use of water is basically a water entropy reducing technology. The WUC societies aim is to reduce water entropy or water disorderliness through water institutions. Water market is an economic solution to reduce water entropy[1].

[1] Personal communication from Prof. RS Deshpande, Director, Institute for Social and Economic Change

Table 4. Characteristics of WUC societies based on percentage of membership in Cauvery command area: 2005

Sl. No.	Characteristics of society	Societies with less than 50 per cent of farmers enrolled as members (LFM) Number of societies =19	Societies with more than 50 per cent of farmers enrolled as members (MFM) Number of societies =11
1	Percentage of area under paddy during summer season (%)	36.26	22.09
2	Number of villages under the jurisdiction of each WUC society	4	4
3	Farmers' cooperation in forming the society (0 = Low cooperation, 1= Moderate cooperation, 2 = High cooperation)	0.84	1.27
4	Transaction cost in forming organization (contribution of time in months)	4.5	4.0
5	Percentage of membership in the society (%)	30.5	54.5
6	Percentage of members attending the general body meeting out of registered members (%)	64.5	60.8
7	Number of farmers in the societies' area	612	492
8	Total fund available with the society per farmer (₹)	148.6	258.9
9	Number of borewells in the command area (No.)	27	19
10	Command area (acres)	1185	1253
11	Percentage of societies receiving one time grant (%)	16	27

Source: Rohith (2007)

Table 5. Characteristics of WUC societies based on number of borewells in each society in command of Cauvery basin: 2005

Sl. No.	Characteristics of society	Societies with less than 24 borewells in the command area (LCWU) Number of societies =19	Societies with more than 24 borewells in the command area (MCWU) Number of societies =11
1	Area under paddy during summer season (%)	34.11	25.82
2	Number of villages under the jurisdiction of each WUC society	4	4
3	Farmers' cooperation in forming the society (0 = Low cooperation, 1 = Moderate cooperation, 2 = High cooperation) as perceived by President of WUCs	1.05	0.91
4	Transaction cost in forming organization (time spent in formation in months)	4.47	4.05
5	Percentage of membership in the society (%)	49	38
6	Percentage of members who attend the general body meetings (%)	67.3	56.0
7	Number of farmers in the command area of WUC societies (No.)	566	232
8	Funds per capita in WUCs (₹)	571	109
9	Command area (acres)	1,245	1,153
10	Percentage of societies receiving one time grant (%)	26	9

Source: Rohith (2007)

The LCWU societies had 34 per cent of area under paddy during summer compared to 25 per cent in the HCWU societies. In the LCWU societies, the percentage of members attending the general body meeting was 67 per cent, which was 20 per cent higher than in the HCWU societies. The fund available to each command area farmer of LCWU societies was ₹ 571 as compared to ₹ 109 for HCWU farmers.

Between the LCWU and HCWU societies there was no difference regarding number of villages under their jurisdiction, extent of farmers' cooperation and transaction cost in forming the organization. The membership percentage of LCWU societies was 10 per cent higher than that of HCWU societies, and 26 per cent of these societies had received the one-time grant. There was uniformity in the number of farmers in the command area and the average command area of LCWU and HCWU societies.

Factors Influencing Farmer's Willingness to Pay (WTP) Additional Water Charges for Assured Summer Irrigation

As all the farmers in different command areas did not receive adequate irrigation during summer, their willingness to pay additional water charges for an assured water supply was estimated. It was found that command area of the farmer and distance of the farm from the canal were the significant factors that influenced the farmers' willingness to pay additional charges for water (Table 6).

Logit regression function, with willingness to pay water charges for assured summer irrigation as dependent variable (Dummy variable = Farmer willing to pay water charge for assured summer irrigation above ₹ 100 was given the value "1" and farmer not willing to pay was given the value "0") was considered. The explanatory variables considered were land holding of farmer, distance of farm from canal outlet (in 100 metres) and dummy variable to indicate the use of bore-well (1 = farmer irrigating with borewell, 0 = farmer not irrigating with borewell), governance of the WUC society (for good and moderate, '1'; '0' otherwise) and location of the farm (1= head reach farm, 0 = tail reach farm). The odds ratio of this function was 6.69 indicating that there are 7 chances that a farmer was willing to pay additional water charges to one chance that a farmer was not willing to pay additional water charge.

Thus, the probability of additional WTP for assured summer irrigation was 0.87, as paddy productivity and profitability are higher during summer. The marginal probability indicated the rate of change in the probability with respect to change in the independent variable. For an increase of 100 meters in the distance of farm from the canal outlet (from the mean), the probability to pay the additional water charges increased by 0.03 from the present probability of 0.87. This indicated the significance of the water distribution among the farms of pipe-outlet command area. Similarly, for one acre increase in the landholding size, the probability to pay the additional water charge increased by 0.028. This

Table 6. Factors influencing willingness to pay additional water charges for assured summer irrigation in Cauvery command: 2005

(Dependent variable: Farmer willing to pay additional water charges, 1 and farmers not willing to pay additional water charges, 0), (Number of sample farmers = 90)

Explanatory variable	β coefficient	Significance	Mean	Marginal additional probability
Performance of WUC society (Good and moderate, 1; poor, 0)	-0.949	0.147	0.667	-0.107
Reach of the farmer's land (head reach =1, tail reach = 0)	-0.106	0.858	0.500	-0.012
Landholding of farmer (acres)	0.249*	0.095	3.123	0.028
Use of borewell irrigation (Yes = 1, No = 0)	0.853	0.294	0.211	0.096
Distance of farm from the canal outlet (in 100 metres)	0.314**	0.005	5.440	0.036
Constant	-0.080	0.915		
Odds ratio = (P/1-P)	6.69			
Probability of additional WTP = (P)	0.870			
Probability of not willing to pay additional WTP = (1-P)	0.130			

Note: ** and * significant at 1 per cent and 10 per cent levels, respectively.
Source: Rohith (2007)

Table 7. Extent of farmers willingness to pay additional water charges for assured summer irrigation in Cauvery command: 2005

(Dependent variable = Farmers willingness to pay additional water charges above ₹ 100; Mean additional WTP = ₹ 77.58; Number of sample farmers = 90)

Explanatory variable	Coefficient	t-value	Mean
Performance of WUC society (Good and moderate, 1; poor, 0)	-23.58	-1.86	0.667
Reach of farmers land (Head reach = 1, Tail reach = 0)	-10.01	-0.87	0.500
Landholding size (acres)	11.45**	4.66	3.123
Use of borewell irrigation (Yes = 1, No = 0)	43.26**	2.61	0.211
Distance of the farm from the canal outlet (in 100 metres)	8.06**	7.82	5.440
Constant	59.07	11.18	

Note: **Significant at 1 per cent
Source: Rohith (2007)

indicated that as the holding size increased, the probability to pay additional water charge for summer irrigation increased.

When the membership of WUC society (member farmer = 1, non-member = 0) was considered as an explanatory variable, the coefficient was not significant, indicating that the membership or non-membership in a WUC society did not influence the willingness to pay additional water charges for summer irrigation. The farm income might be one of the important factors influencing the willingness to pay, but it was dropped from the model as it had low coefficient value and was insignificant. The amount generated from the additional water charges could be used in operation and maintenance of the WUC society to improve the water-use efficiency.

Functional Analysis to Find the Extent of Farmers' Willingness to Pay Additional Water Charges for Assured Summer Irrigation

With the high (logit) probability that a farmer was willing to pay for assured summer irrigation, the actual willingness to pay for assured summer irrigation was estimated by tobit regression analysis (Table 7). It was found that landholding of the farmer, use of borewell irrigation and distance of the farm from canal were the significant factors influencing farmer's willingness to pay. The mean additional charge that the farmer was willing to pay was ₹ 178. It was found that farmers possessing borewell with a landholding of 3 acres, located at a distance of 548 metres from canal outlet, in head reach of a good governance WUC society were willing to pay an additional water charge of ₹ 127. If a similar farm was located further away by 100 metres (650 m), the farmers were willingness to pay an additional amount of ₹ 8. This indicated the significance of the distance from the canal outlet as well as the prevalent wide disparity in water distribution.

In the study area, some of the pipe-outlets were not functioning properly, which was causing loss of water. Most of the field channels were not lined, which instigated nearer farms to irrigate their land frequently though the farther reach farmers had not received their first irrigation. Ravi *et al.* (2002) in their study on the Bhadra canal command area of Karnataka, have reported that the willingness of farmers for timely and adequate supply of irrigation water was ₹ 189 and it differed with farm location (Head reach: ₹ 151, Middle reach: ₹ 178, and Tail reach: ₹ 238).

Similarly, if the landholding size increased by one acre, farmer was willing to pay an additional amount of ₹ 11 (above ₹ 100) towards water charges. It was observed that farmers having borewell irrigation, were willing to pay ₹ 43 as additional charge, which is a significant variable influencing the WTP. This shows that the farmers have realized the importance of surface irrigation to recharge their borewell. Even with their current level of access to surface water, farmers with borewell irrigation were also willing to pay additional water charge for summer irrigation. For a WUC society with good governance, the WTP falls since good governance increases access to water. The implication of WTP analysis is that farmers with access to groundwater irrigation have the highest willingness to pay for additional water charges and it highlights the economic value of water in Cauvery command area.

Conclusions

This study has analysed the performance of 30 WUC societies formed in Tirumakudalu Narasipura taluk of Mysore. Twenty per cent of the WUC societies have been performing well with 50 per cent of membership, and every society has received an average fund of around ₹ 3 lakhs through membership fee, one-time grant and godown grants. Members in these societies have exhibited better cooperation, where 75 per cent of member farmers attend the general body meetings. Despite the odds being faced by the cooperative venture, about 20 per cent of the WUC societies have a comfortable funding position, while the remaining 80 per cent need to improve their performance to receive the one-time and godown grants.

Small and large farmers have been found becoming members of WUC societies, compared to marginal farmers. Farmers whose land is located away from the canal pipe outlet, are not as much willing to become members of a WUC society, but are willing to pay more towards assured summer irrigation. These farmers are not confident that WUC society will ensure equal distribution of water. The odds ratio determined using logit model has indicated that there are seven chances of willing to pay additional charges for assured summer irrigation for every one chance of not willing to pay additional water charges.

Holding size of farmer, use of borewell irrigation (signifying conjunctive use) and distance of the farm from canal were the significant factors influencing farmer's willingness to pay for assured summer irrigation. The mean additional charge for canal water that the farmer was willing to pay has been found as ₹ 178 on and above ₹ 100.

Appropriate education and training programme should be initiated to motivate the marginal farmers to enroll as member of WUC societies. They need to be educated to regard water as an economic good. Thus, there is considerable potential for the moderately and poorly performing WUC societies to catch up with well performing WUC societies. With all the odds being faced by the cooperatives, the study has revealed the inner strength of a water users cooperative in canal water distribution through collective action.

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