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SUSTAINABLE PLANNING AND MANAGEMENT OF WATER USERS ASSOCIATIONS FOR ENHANCED AGRICULTURE

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Abstract
Irrigation tanks in India are common property resources. Conservation of water in the agricultural sector is essential since water is necessary for the growth of plants and crops. Farmer's Organizations need to be empowered to assess the irrigation coverage. WUA is a group of water users, such as irrigation; who pool their financial, technical, material and human resources for the operation and maintenance of a water system. Proper usage of available sources of water by dynamic WUA gives best result in terms of increased cultivated areas in tank command. Hence two tanks namely, Pillapakkam and Irumbedu (villages with active WUA) of Kancheepuram district, Sriperambathur taluk in Tamilnadu were selected for this study to probe the impact made by active WUAs on agricultural productivity. Primary data was collected through interview schedules and analysed using Statistical Package for Social Science (SPSS). Expected result gives the regression equation for farm size, income and expenditure. Hence it is necessary to form a new WUA in the villages where it has not yet been established. Also WUA should be revived in places where it is not functioning well for improved livelihood of village people.

Key words: Agriculture, Irrigation, Water User's Association, Regression analysis

1. Introduction

In Tamilnadu state of India, tank irrigation system plays a very important part as they account for nearly one-third of the irrigation extent. The rainfed tank sector has traditionally been an important mainstay of Tamilnadu rural economy. In the years following independence, the performance of the sector declined for a number of economic and institutional reasons one among the predominant is inactive Water user's Association (WUA) in villages. A Water User Association (WUA) or Water User Board (WUB) is a group of water users, such as irrigators, who pool their financial, technical, material, and human resources for the operation and maintenance of a water system. A WUA usually elects leaders, handles disputes internally, collects fees, and implements maintenance. In most areas, WUA membership depends on one's relationship to a water source (such as groundwater or a canal). The specific nature of the service that a WUA provides will differ from case to case: as the name suggests, a WUA is an institution that serves its members. Because member needs will differ from one area to another, a WUA is normally established in response to the aspirations of its members. That is, its design conforms to their specifications. It is a co-operative association of individual water users who wish to undertake water-related activities for their mutual benefit. WUAs are ideally both wholly controlled by and accountable to their members, they also impact upon the overall quantity and quality of the water resources in the catchment in which they are located. The activities of one WUA may impact upon those of another WUA situated further downstream, so that there is also a need to plan the utilization of the resource amongst WUAs. Institutions would be effective only if the economic gains are substantial (Rathna Reddy and Prudhvikar Reddy 2005).

2. Methodology

2.1 Study area

Pillaipakkam village is located at latitude of 12^{o} 9' N and at longitude of 79^{o} 9' E. The total village area is 322.60 hectares and consists of 342 households. The total irrigated land is 176.27hectares and rain fed land is 146.33hectares. The only source of irrigation for this village is tank (Pillaipakkam tank). The irrigation schemes

are available in this village which is organized by the Water users association (WUA). There are 7sluice present in the tank of this village. Depth of water stored in the tank is about 4.04 meters.

Irumbedu village is located at latitude of 12° 9' N and at longitude of 79° 9' E with a total area of 161.11hectares. This village has only tank irrigation system (Irumbedu tank) and the length of the tank is 1950 meters. Water users association is active in this village. Total irrigated area is 76.97.5 hectares and rain fed land is 84.22.5 hectares. The soil type is black cotton soil. Total population of the village is 2100. There are only three sluices present in the village tank.

Two villages i.e. Irumbedu and Pillaipakkam were selected with WUA on function. Further, respondents are classified according to reach, source of water, size of land holding in hectares. The farmers within reach were again grouped as head, middle and tail. For e.g. consider that field channel is about 3km. Head reach indicates the farmers whose land is very near to the source (tank) or within starting 1km of field channel. Middle reach indicates the farmers having land after the head reach or within next 1km of the channel. Similarly, tail reach indicating the farmers holding land at the last 1km i.e end of the field channel in command area. Respondents are classified according to the source of water they irrigate i.e well or tank users. In selected villages, all the farmers are only tank users. During first season no cropping is done due to non- availability of water, for second season (July to Jan) they use only rain water throughout the season. And for the third season (Jan to May) only water stored in the tank is used. Depending on their size of land holding as marginal, small and big. Marginal include the farmers holding land less than 1ha whereas small include the farmers having land between 1ha-2ha similarly big include the farmers with more than 2ha. According to the above matrix the details of individual farmers are collected. Gathered information through interview schedule is analyzed using Statistical Package for Social Science (SPSS). Regression equation for farm size, income and expenditure is arrived to show the increased cultivated area with the help of active Water Users Association.

3. Analysis and Interpretation

3.1 Regression Analysis for Total Land Holding by the Respondents

1. Dependent Variable : Farming Expenditure (Y)
2. Independent Variable : Income in Rs (X1) and Size of land in acres (X2)
3. Multiple R Value : 0.767
4. R Square Value : 0.589
5. Adjusted R Square Value : 0.572
6. F Value : 36.484
7. P Value : 0.000**

*Note: ** refers it is more significant at 1 % level.*

Here the dependent variable is farming expenditure and independent variables are income in rupees and size of land in acres. Multiple R values show the correlation coefficient between actual value of Y and the predicted value of Y. Since R^2=0.589 which is greater than 0.5, it is highly correlated. R^2 value is the coefficient of determination. Here 58.90% information about farming expenditure is extracted from income and size of land holding. Adjusted R^2 value is 0.572 and R^2 value is 0.589, which means sample number is higher than Y. Since P-value is less than 0.01, R^2 is highly correlated at 1% level in case of total land holding by the respondents.

Table 1 Regression Analysis for Total Land Holding by the Respondents

Model	Unstandardised Coefficients		Standardised Coefficients	t- value	p-value
	B	Std.Error	Beta		
Constant	4.775	0.626	-	7.634	0.000
Net income (X1)	-0.322	0.210	-0.166	-1.530	0.132
Total land holding(X2)	0.840	0.107	0.847	7.828	0.000

3.2 Regression Equation for Total Land Holding by the Respondents

Y = 4.775 + 0.332 X1 + 0.840 X2

It is proved from the Table 1, if income is increased by Rs.1000, then the expenditure is increased by Rs.166 and if 1 acre of land is cultivated by the respondents, then expected increase in expenditure is Rs.847.

3.3 Regression Analysis for Total Cultivated Land by the Respondents:

1. Dependent Variable : Farming Expenditure (Y)
2. Independent Variable : Income (X1) in Rs and Size of Land in acres (X2)
3. Multiple R Value : 0.764
4. R Square Value : 0.584
5. Adjusted R Square Value : 0.568
6. F-Value : 35.840
7. P-Value : 0.000**

*Note: ** refers it is more significant at 1 % level.*

Here the dependent variable is farming expenditure and independent variables are income in rupees and size of land in acres. Multiple R values show the correlation coefficient between actual value of Y and the predicted value of Y. Since R^2=0.584 which is greater than 0.5, it is highly correlated. R^2 value is the coefficient of determination. Here 58.40% information about farming expenditure is extracted from income and size of land holding. Adjusted R^2 value is 0.568 and R^2 value is 0.584, which means sample number is higher than Y. Since P-value is less than 0.01, R^2 is highly correlated at 1% level in case of total cultivated land by the respondents.

Table 2 Regression Analysis for Total Cultivated Land by the Respondents

Model	Un-standardized Coefficients		Standardized Coefficients	t- Value	p -Value
	B	Std.Error	Beta		
Constant	4.802	0.630	-	7.624	0.000
Net income (X1)	-0.328	0.212	-0.169	-1.547	0.128
Total cultivable land (X2)	0.420	0.054	0.847	7.752	0.000

3.4 Regression Equation (For Total Cultivated Land):

$Y = 4.802 + 0.328\ X1 + 0.420\ X2$

It is proved from the Table 2, if income is increased by Rs.1000, then the expenditure is increased by Rs.169 and if 1 acre of land is cultivated by the respondents, then expected increase in expenditure is Rs.847.

A total income and expenditure detail for one acre of paddy cultivation is clearly shown in Table3. From nursery to harvest, crop grown period is 135 days. Different varieties of paddy cultivated in Tamilnadu are Ponni, Super ponni, ADT-43, ADT-45, Bapatlal etc. In study villages, Super ponni is cultivated widely. The final produce is 25 bags/acre at the cost of Rs.1000/bag (each bag weighs 75kg). Hence the total gross income from one acre of paddy cultivation is Rs.25,000/-. On the other hand the expenses constitutes various activities like nursery, ploughing, sapling, fertilizer and pesticide application, weeding, harvesting, transportation, marketing etc. Approximately 20 kg of seeds are required for one acre of paddy cultivation at the cost of Rs.25/kg. Three persons are in need of nursery work at Rs 230/person. For transplantation 10 labours are necessary at Rs 200/person as wage rate. DAP, urea, potash and gypsum are applied as fertilizer and Prudon is sprayed three times as insecticide. Removal of weed needs 9 workers at Rs 100/person. Machine harvest is carried out at the cost of Rs 1500/acre for 2.30 hours. While marketing, 25 bags of paddy will be transported from field to market at the cost of Rs 300/acre. Mediator cost is approximately 2% of gross income. Hence the total expenditure is Rs 13,620/-. Net profit is arrived by deducting total expenses from gross income.

Table 3 Total income and Expenditure details for one acre of paddy cultivation in study villages

S.No	Descriptions	Particulars
1	Total Cultivated land in acre	1
2	Crop	Paddy
3	Variety	Super ponni
4	Period in days	135
5	No. of bags/acre	25
6	Rate per bag (Rs.)	1000
9	Cost of total bags (Rs.)	25000
11	**Gross Amount (Rs.)**	**25000**
12	Required seed quantity in kg for 1 acre	20
13	Rate of Seed(Rs./Kg.)	25

14	Cost of Seed (Rs.) for 1 acre	500
15	Amount spent on nursery (Rs.) for 1 acre	700
16	Ploughing charges/acre in Rs	3.000
17	Cost Spent on Sapling (Rs.)	2,000
17	Main fertilizer expenses (Rs.)	2000
18	Cost of additional fertilizers (Rs.)	380
20	Cost Spent on Pesticides (Rs.)	1,500
21	Cost Spent on Preventing Crop from fungal Diseases(Rs.)	500
22	Cost Spent on Weeding (Rs.)	900
23	Harvesting Cost (Rs.)	1,500
24	Transportation Cost (Rs.)	300
25	Mediator Cost (Rs.)	340
26	**Total Expenses (Rs.)**	**13,620**
27	**Net Profit for 1 acre (Gross Income- Total Expenses) (Rs)**	**11,380**

4. Discussion and Conclusion

Traditional tank institutions in Pillapakkam and Irumbedu have undergone changes because of vast increase in the number of irrigators, shifts in control of the land from a few to many landowners, changes in the attitude of farmers and the spread of well irrigation in tank commands. However, a new Water Users Association (WUA) was formed in the year 2001 during the tank rehabilitation. This association is functioning differently when compared to other irrigation systems. It has its own way of maintenance and management to bring in efficient and equal distribution of water to the farmers. Similar experiences are found elsewhere, where in, informal and socially embedded institutions are more effective than the formal associations since it is flexible in adapting to the changing situations (Rathna Reddy and Prudhvikar Reddy, 2005). In the WUA of Pillapakkam and Irumbedu village there are two executive members, one Treasurer and three team members including the President. Members are equally distributed among all the three field channels in the command area. Irrespective of the landholding size, only *Pattardhars* (landholders) are eligible to become a member of this association. Farmers having as minimum as 3 cents to as maximum as 6 ha in tank command area can register as members of the WUA. In order to form the Association, atleast 70% of ayacutdhars should be registered as members and each has to pay Rs.10 as membership fee as one time payment. Revenue generation, to be vested with the WUA, will help achieve both the management and technology options resulting in the optimisation of production across all uses (Palanisamy and Meinzen-Dick 2001). Accounts are handled by the Subdivision Officer and the Tank President. Both have to sign for all banking operations. The WUA in Pillapakkam and Irumbedu village involved the village farmers with their labour and cash in the rehabilitation projects. This involvement prepared them to understand the benefits that are going to be experienced by them and their specific roles in decision making, implementation, maintenance and management of the rehabilitated tank system. The transparency and cordial communal decision-making have kept the institution vibrant in Pillapakkam and Irumbedu village. Homogenous caste group of this village plays a major role in the functioning of WUA at highly efficient and appreciable level.

The President of the WUA is doing an excellent job in obtaining all possible funds offered by the Government for tank developmental activities in Pillapakkam and Irumbedu village. This made the villagers to keep the President vibrant and obey his words regarding tank maintenance and operation. Even though formal and regular meetings are not conducted by the WUA they are meeting whenever it is necessary. The most common function of the President is to call for a meeting of *Ayacutdhars* as soon the tank starts receiving supply through its feeder channel in order to take a decision on water distribution and management. *Neerkatis* (a local term of water managers) announce the meetings in and around the villages by beating a drum. In the meeting, it will also be decided when to start the maintenance work and level of contribution of labour and cash by each ayacutdhar. The success of an irrigation institution depends on its capability to bring water, manage it effectively and distribute it equitably. Increase in agricultural production, increase in area irrigated, income generated and development of other associated. Irrespective of the location of land (head, middle and tail), Source of water used (Tank alone or tank and well together) and Size if land holding by the farmers (Marginal, small and medium) respondents can easily get water for irrigation with out any obstruction. So that, the available water can be utilized efficiently for the entire command area for all the two seasons of paddy cultivation. Improving the tank management will enhance tank supplies which in turn will reduce the demand for more number of wells in the tank command area and hence efforts should be made to improve the system efficiencies through tank modernisation strategies involving the water users organisations / associations (Palanisami et al 2008). Hence it is necessary to form a new WUA in the villages where it doesn't exist so far. Also WUA should be revived in a place where it is not functioning well for better livelihood of the people who are depending upon agricultural activities.

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