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Efficiency Measures of Water Users Association in Tirunelveli District of Tamil Nadu

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Abstract
The water use efficiency could be enhanced by ensuring adequate and timely water availability at the delivery system and by facilitating efficient on-farm use of the irrigation water to optimize agricultural production. Systematic and scientific approach is needed for optimizing water and other resources use to increase the performance efficiency of existing irrigation projects in terms of productivity per hectare. Water Users' Associations (WUA) are voluntary, non-governmental, non-profitable entity established and managed by a group of farmers located along one or several water source canals. Water users include farmers, peasants and other owners who pool together their financial, material and technical resources to improve the productivity of irrigated farming through equitable distribution of water and efficient use of irrigation and drainage systems (USAID, 1992). Hence, a study on Water Users' Association and problems relating to allocation, distribution and efficient use of water and also to assess the impact and participation of farmers in WUAs of the selected areas in terms of farm productivity becomes very important. The studies on performance of WUAs in Tamil Nadu especially in Tirunelveli were very much limited. Therefore an attempt was made to study the economic impacts of WUAs' on productivity of major crops in Thamirabarani river basins.

Keywords: Water Users Association, on-farm use, irrigation water, agricultural production

Introduction

Review of Literature

Kumar *et al.* (2005) estimated efficiency levels of irrigated rice farms of Uttaranchal using Data Envelopment Analysis (DEA) approach. The average level of the overall technical efficiency for irrigated rice farms growing local variety was 75 per cent. The estimated average technical efficiency of farms where improved rice technology had been adopted was 92 per cent. This study suggested that the technical efficiency of rice farms growing local variety could be increased by using the new improved varieties of rice.

Ramarao *et al.* (2003) analyzed the technical efficiency of rice farms of West Godavari district of Andhra Pradesh. The average level of technical efficiency was estimated at 85 per cent indicating that it was possible to improve yield by 15 per cent by following the efficient crop management practices.

Technical efficiency in the present study is defined as the ratio of frontier yield i.e., the maximum yield to actual yield realized under existing level of inputs use and technology.

Materials and Method

The major objective of the present study is to assess the impact of Water Users' Association on productivity and farm income in the member farms households of Thamirabarani river basins. The present study was conducted in Thamirabarani river basins which had the largest number of WUAs' (132) in 250 villages. Hence, it was purposively selected to study the impacts and characteristic features of WUAs. Tamil Nadu is pioneer in Water Users' Association especially southern Tamil Nadu i.e., Tirunelveli district in Thamirabharani river basin have been selected. The study covered 60 farmers under WUAs and 40 farmers under Non-WUAs in each of the selected river basins and thus making the total sample size at 100 farmers. The method used for collecting the primary data was simple random sampling technique. A list of all WUAs was obtained from the selected district. Based on the location of distributary channel, the taluks were selected. From the list of WUAs, a sample 60 members and 40 non-members of WUAs in each of the selected villages were randomly selected .Thus, 60 members and 40 Non-members of Thamirabarani (Ambasamudram Taluk of Tirunelveli district)

Result and Discussion

1.1 Technical, Allocative and Economic Efficiencies of Paddy Farms in Thamirabarani River Basins (Water Users' Association Members)

The results of the data envelopment analysis of technical efficiency, allocative efficiency and economic efficiencies of paddy farms among water users' association members in Thamirabarani river basin are given in Table 1.

Table 1: Level of Technical, Allocative and Economic efficiency in Paddy Farms in Thamirabarani River Basins (Water Users' Association Members) (Numbers)

Efficiency level	Technical Efficiency	Allocative Efficiency	Economic Efficiency
Less than 50	5 (8.33)	6 (10.00)	15 (25.00)
51-60	-	17 (28.33)	17 (28.33)
61-70	1 (1.67)	18 (30.00)	14 (23.33)
71-80	2 (3.33)	10 (16.67)	11 (18.33)
81-90	1 (1.67)	8 (13.33)	2 (3.33)
More than 90	51 (85.00)	1 (1.67)	1 (1.67)
Total number of farmers	60 (100.00)	60 (100.00)	60 (100.00)
Mean	0.89	0.66	0.59

*Figures in parentheses indicate percentage to number of farmers.

Of the 60 paddy member farmers of WUAs in Thamirabarani river basins, 85 per cent of the members were operating at the technical efficiency range of above 91-100 per cent and those with the technical efficiency of less than 50 per cent accounted for 8.33 per cent. There were no members belonging to technical efficiency between 51-60 per cent. The mean technical efficiency of 0.89 for all the members would indicate that the output can be raised by 11 per cent by following efficient crop management practices without increasing the levels of application of inputs.

Table 1 also revealed that 30 per cent of the members in Thamirabarani river basin were allocatively efficient in the range between 61 and70 per cent followed by

28.33 per cent of members ranges between 51 to 60 per cent. The mean allocative efficiency of members in WUAs was 66 per cent. This result revealed that 34 per cent of the resources were inefficiently allocated relative to the best farm practice producing the same output and facing the same technology in Thamirabarani river basin. This advocated that allocative efficiency among the respondents could be increased by 34 per cent in the study area through the better utilization of resources in optimal proportions for crop production with the current state of technology. This would enable farmers to equate the marginal revenue product of output to the marginal input cost, thereby improving the paddy yield among members of WUAs' in Thamirabarani river basin.

The mean economic efficiency score of members of WUAs was 0.59. This would show that about 41 per cent of the respondents were not economically efficient and were not able to minimize the cost of production of paddy. This would indicate that overall economic efficiency among the respondents could be increased by 41 per cent through reduction in production costs that would occur if paddy production were to occur at the allocatively and technically efficient points given the current state of technology.

1.2. Technical, Allocative and Economic Efficiencies of Paddy Farms in Thamirabarani River Basins (Water Users' Association Non-Members)

The technical efficiency, allocative efficiency and economic efficiencies of paddy farms among the non-members water users' association in Thamirabarani river basin are given in Table 1.1

Table 2: Level of Technical, Allocative and Economic Efficiency in Paddy Farms in Thamirabarani River Basins (Water Users' Association Non-members) (Numbers)

Efficiency level	Technical Efficiency	Allocative Efficiency	Economic Efficiency
Less than 50	11 (27.50)	-	12 (30.00)
51-60	1 (2.50)	8 (20.00)	9 (22.50)
61-70	-	17 (42.50)	9 (22.50)
71-80	2 (5.00)	8 (20.00)	6 (15.00)
81-90	4 (10.00)	3 (7.50)	3 (7.50)
More than 90	22 (55.00)	4 (10.00)	1 (2.50)
Total number of farmers	40 (100.00)	40 (100.00)	40 (100.00)
Mean efficiency	0.73	0.71	0.53

*Figures in parentheses indicate percentage to number of farmers.

Among 40 non-members of paddy farms in Thamirabarani river basins, 55 per cent of the paddy farms were operating at the technical efficiency range of above 91-100 per cent followed by technical efficiency which ranges less than 50 per cent, i.e., with 27.50 per cent. The mean technical efficiency of 0.73 for paddy farms would indicate that the output can be raised by 27 per cent by following efficient crop management practices without any increase in the level of application of inputs.

The result of the mean allocative efficiency score by paddy farms among non-members in Thamirabarani river basins was 0.71. About 42.50 per cent of the sample farmers were allocatively efficient in the range between 61 and 70 per cent and no farm was noticed in the range below 50 per cent. This result revealed that 29 per cent of the resources were inefficiently allocated relative to the best farm practice producing the same output and facing the same technology in the study area. This advocated that allocative efficiency among the non-members could be increased by 29 per cent in the study area through the better utilization of resources in optimal allocation for crop production with the current state of technology. This would enable farmers to equate the marginal revenue product of output to the marginal input cost, thereby improving the paddy yield.

The mean economic efficiency score of paddy farms among non-members in Thamirabarani river basins was 0.53. This shows that about 47 per cent of the respondents were not economically efficient and were not able to minimize the cost of production. This indicates that overall economic efficiency among the respondents could be increased by 47 per cent through reduction in production costs that would occur if production were to occur at the allocatively and technical efficient point given the current state of technology.

2. Determinants of Technical Efficiency

2.1. Factors Determining the Technical Efficiency of Rice Cultivation

The factors influencing the technical efficiency in rice cultivation for members under Thamirabarani river basin have been identified using linear regression model. The dependent variable was technically efficiency estimated from the frontier production function.

The explanatory variables such as age of the respondent, experience in farming, education level, and size of land holding were included in the model. The coefficients would reflect the impact of the explanatory variables on the technical efficiency attained by the sample farmers.

It is evident from Table 2. that among the variables, size of land holding, education level, and Farming Experience of the respondents were having significant influence on the technical efficiency of sample farmers in rice cultivation under Thamirabarani river basin.

Table 2: Factors Determining the Technical Efficiency under Thamirabarani River Basin

Sl. No.	Variables	Members		Non-members	
		Regression Co-efficient	Standard Error	Regression Co-efficient	Standard Error
1.	Intercept	0.904***	0.034	0.816 ***	0.026
2	Land holding	0.037***	0.011	0.005 **	0.002
3	Age of respondents	-0.001 NS	0.001	0.003***	0.0005
4	Education level of respondents	0.044**	0.022	0.0001 NS	0.007
5	Farming Experience of the respondents	-0.009***	0.002	-0.004 ***	0.001
	R^2	0.62		0.45	
	Number of observation	60		40	
	F-value	14.36		11.20	

* - Significant at 1 per cent level, ** Significant at 5 per cent level, *** - Significant at 10 per cent level.

From the above table, it could be inferred that, one per cent increase in the education level of member respondents would increase the technical efficiency of the sample farms by 0.044 per cent level. Similarly one per cent increase in the land holding of the respondents would increase technical efficiency by 0.037 per cent and one per cent increase in the farming experience of the respondents would decrease technical efficiency by 0.009 per cent. In case of non-members, one per cent increase in the age of respondents would increase the technical efficiency of the sample farms by 0.003 per cent level. Similarly one per cent increase in the land holding of the respondents would increase technical efficiency by 0.005 per cent and one per cent increase in the farming experience of the respondents would decrease technical efficiency by 0.004 per cent.

Summary and Conclusion

Technical, Allocative and Economic Efficiencies of Paddy Farms in Thamirabarani River Basins

Of the 60 paddy member farmers of WUAs in Thamirabarani river basins, 85 per cent of the members were operating at the technical efficiency in the range of 91-100 per cent and those with the technical efficiency of less than 50 per cent accounted for 8.33 per cent. There was no member belonging to technical efficiency between 51-60 per cent. The mean technical efficiency of 0.89 for all the members would indicate that the output can be raised by 11 per cent by following efficient crop management practices without increasing the levels of application of inputs. The mean allocative efficiency of members in WUAs was 66 per cent. This result revealed that 34 per cent of the resources were inefficiently allocated relative to the best farm practice producing the same output and facing the same technology in Thamirabarani river basin. The mean economic efficiency score of members of WUAs was 0.59. This would show that about 41 per cent of the member respondents of WUAs were not economically efficient and were not able to minimize the cost of production of paddy.

Among 40 non-members of paddy farms in Thamirabarani river basins, 55 per cent of the paddy farms were operating at the technical efficiency in the range of 91-100 per cent followed by technical efficiency which was less than 50 per cent, i.e., with 27.50 per cent. The mean technical efficiency of 0.73 for paddy farms indicated that the output can be raised by 27 per cent by following efficient crop management practices without any increase in the level of application of inputs. The result of the mean allocative efficiency score by paddy farms among non-members in Thamirabarani river basins was 0.71. About 43 per cent of the sample farmers were allocatively efficient in the range between 61 and 70 per cent and no farm was noticed in the range below 50 per cent. This result revealed that 29 per cent of the resources were inefficiently allocated relative to the best farm practice producing the same output and facing the same technology in the study area. The mean economic efficiency score of paddy farms among non-members in Thamirabarani river basins was 0.53. This showed that about 47 per cent of the respondents were not economically efficient and were not able to minimize the cost of production.

The results of analysis on factors influencing the technical efficiency in rice cultivation for members in Thamirabarani river basin have indicated that size of land holding, education level, and farming experience of the respondents were having significant influence on the technical efficiency of sample farmers in rice cultivation under Thamirabarani river basin. In case of non-members, one per cent increase in the age of respondents would increase the technical efficiency of the sample farms by 0.003 per cent level. Similarly one per cent increase in the land holding of the respondents would increase technical efficiency by 0.005 per cent and one per cent increase in the farming experience of the respondents would decrease technical efficiency by 0.004 per cent.

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