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Research Article

ASSESSING THE SOCIAL IMPACT OF INTEGRATED WATERSHED MANAGEMENT PROGRAMME IN WESTERN ZONE OF TAMIL NADU

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A B S T R A C T

Present climatic scenario urges to monitor and evaluate the impact of watershed development and soil conservation programmes which are multi-sectoral complexity. Integrated Watershed Management Programmesupports the farmers in intensifying their agricultural production that enables them to enhance their employment and income. The present study was based on comparison of the household in the watershed area (treatment) and non-watershed area (control) in Coimbatore district of Tamil Nadu. Key indicators of social impacts are selected on the basis of employment generation by the programmes and which in turn affected migration of the community as well. To assess the impact, the difference-in-differences method was applied to compare the changes in outcomes over time between the treatment group and the control group. Labour utilization percentage was worked out as 72.63 per cent for treatment group and 49.40 per cent for control group. A decline was noticed in all categories of farmers in the permanent migration as compared to seasonal migration. The data also suggests that the seasonal as well as permanent migration of skilled labor in all categories of farmers were more reduced as against to the unskilled labor in the study area.

INTRODUCTION

The main aim of the integrated watershed development programme is to conserve the natural resources specifically soil and water resourcesas an effective approach in watershed management. It is recognised as the potential engine for agriculture growth and development in fragile and marginal rain-fed areas (Joshi *et al*., 2005; Wani*et al*., 2008). Apart from resource conservation, watersheds support the farmers in diversifying and intensifying their agricultural production in such a way that it enables them to enhance their employment and income in the watershed areas (Shivakumara and Murthy, 2020). Hence, this will influence the social status of the people who belonging to the treated area. The success of such agricultural and rural developmental programmes relies on the extent of progress of the livelihood in the community (Kavitha*et al.*, 2022). By bringing this point as an objective, the impact of Integrated Watershed Development Programme is assessed on the aspect of social importance created by the programme.

MATERIALS AND METHODS

For the purpose of studying impact assessment of watershed, Coimbatore district of Tamil Nadu was purposively selected as the work in this watershed has been completed in the Western zone of Tamil Nadu. The present study was based on the data collected from the household in the watershed area (treatment) and non-watershed area (control). The watershed development programmers implemented under IWMP (2011-12) batch of VII was taken up in five micro watersheds of Coimbatore district namely Arasampalayam, Mettuvavi I, Mettuvavi II, Vadasithur and Pachapalayam II. Field survey was conducted at all the farm households of these treatment group and the adjoining control units of Kothavadi, Andipalayam, Periyakalanthai, Karacheri, Thirumalayamapalayam. The samples from the watershed area are derived by employing before/after approach both in the treated and control villages employing with/without approach which are used on the basis of objectives. The sample size comprised up of 159 agricultural households from the treatment watersheds and 176 agricultural households from the control groups, thus total size is 335 respondents. The data for the impact evaluation were derived from survey-based data collection comprising close ended questionnaires.

Social Indicators

The social components of the watershed developmental programmers are more important like as technical components. Key indicators which representing social impacts are selected

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on the basis of employment generation by the programmers and which in turn affected migration of the community as well. This means identifying the variables that the interventions are aiming to affect, indicators of those variables, and the people who are the intended beneficiaries (Sharda *et al*., 2012).

Employment opportunities

The approach of this analysis of impact on employment opportunities aslabour utilization can be measured by considering the difference between treatment and control. Firstly, "after implementation" parameters compared to the "before" situation gives the incremental benefits due to the project in the treatment group and in the same way, the difference was arrived for the control group too. Finally, the incremental change between treatment and control is obtained to measure the impact on labour utilization. This method automatically incorporates the correction for the impact of technology in the absence of the project (Palanisamiand Suresh Kumar 2009). Hence, the approach is a combination of both with and without and before and after approaches i.e. double difference method. To estimate various components of labour availability, initially, effective labour available per household were obtained by considering monthly labouravailability and subtracting from it non availability because of sickness, festivals and various unforeseen. To obtain estimates of labour utilization for crop and non-crop activities, the current magnitudes of labour use for all activities were calculated. These activities include crop production, animal husbandry and various non-farm activities. The returns to per unit of labour input have also been estimated for both watersheds and control villages by using budgeting technique (Mondal and Loganathna, 2013).

Migration

The employment opportunities generated additionally in terms of man-days for the watersheds as a whole is computed considering the standards used for each productive activity. Upgraded man-days through employment generation have been created across the watersheds, which has considerably reduced out-migration from the watershed areas. In addition, members who are pursuing livelihoods are engaged throughout the year which was not the case before the project.

Difference-in-Differences (DiD) Method

The difference-in-differences method compares the changes in outcomes over time between a population that is enrolled in a program (the treatment group) and a population that is not (the comparison group). However, what if we combined the two methods and compared the before-and-after changes in outcomes for a group that enrolled in the program with the before-and-after changes for a group that did not enroll in the program? The difference in the before-andafter outcomes for the group, the first difference controls for factors that are constant over time in that group, since we are comparing the same group to itself. But we are still left with the factors that vary over time for this group. One way to capture those time-varying factors is to measure the before-and-after change in outcomes for a group that did not enroll in the program but was exposed to the same set of environmental conditions will produce the second difference. If we "clean" the first difference of other time-varying factors that affect the outcome of interest by subtracting the second difference, then we have eliminated a source of bias that worried us in the simple before-and-after comparisons. The difference-in-differences approach does what its name suggests. It combines the two counterfeit estimates of the counterfactual (before-and-after comparisons, and comparisons between those who choose to enroll and those who choose not to enroll) to produce a better estimate of the counterfactual. Data may be collected for both watershed treated villages and control villages before and after watershed development intervention. This enables the use of the double difference method to study the impacts due to watershed development intervention. The framework was adopted from the program evaluation literature (Maluccio and Flores, 2005).The approach removes biases in post-intervention period comparisons between the treatment and control group that could be the result from permanent differences between those groups, as well as biases from comparisons over time in the treatment group that could be the result of trends due to other causes of the outcome. For the present study, the information were collected for the pre and post-project period and compared with the control as well (Table 1). Hence, the approach is a combination of both with and without and before and after approaches i.e. double difference method.

Table 1 Difference-in-differences method

Particulars	After watershed implementation	Before watershed implementation	Difference across time
Treatment group	B	A	B - A
Comparison group	D	C	D - C
Difference across groups	B - D	A - C	DD = (B – A) – (D – C)

Difference-in-differences (DD) methodology is becoming a popular tool for studying the impact analysis as it has the advantage to control for the time-invariant characteristics of farmers when comparing adopters and non-adopters of a technology or a capacity building program. In this methodology, the average impact of a capacity building program is computed by the formula (Palanisami*et al.,* 2014).

$$\text{DiD} = E(Y_1^T - Y_0^T \mid T_1 = 1) - E(Y_1^C - Y_0^C \mid T_1 = 0)$$

WhereY_t^T and Y_t^C respectively denote the outcome responses for the trained and control groups at period t (=0, 1) where the time period t = 0 corresponds to the period before implementation of watershed program and the period t = 1 corresponds to after implementation of watershed program. Further, T_1 = 1 means presence of the program at time t = 1 and T_1 = 0 means absence of the program. The first term in Equation (1) represents the average difference between before-after for the trained group and hence it is given by

$$E(Y_1^T - Y_0^T \mid T_1 = 1) = \frac{1}{N_T}\sum_{i \varepsilon T} (Y_{i1} - Y_{i0}) = \overline{y_{T1}} - \overline{y_{T0}}$$

Similarly for the control group, the second term is given by

$$E(Y_1^C - Y_0^C \mid T_1 = 0) = \frac{1}{N_C}\sum_{j \varepsilon C} (Y_{j1} - Y_{j0}) = \overline{y_{C1}} - \overline{y_{C0}}$$

Substituting these values in (1), the impact of the program can be obtained as

$$\text{Impact} = (\overline{y_{T1}} - \overline{y_{T0}}) - (\overline{y_{C1}} - \overline{y_{C0}})$$

The same results can be obtained by following a regression approach as follows: For each observation i, let us define a variable δ_i as δ_i = 0 if the observation is from the control group and δ_i = 1 if it is from the trained group. Similarly for each observation i define a variable T_i as T_i = 0 if the observation belongs to time t = 0, that is before implementation of watershed program and T_i = 1 if the observation belongs to time t = 1, that is, after implementation of watershed program. Now form the regression equation

$$y_i = a + b\delta_i + cT_i + d\delta_i T_i$$

Table 2 Observations before and after implementation

Sl.No.	Observations	δ	T	y_i
1.	Control group before the program	0	0	$\overline{y_{C0}} = a$
2.	Control group after the program	0	1	$\overline{y_{C1}} = a + c$
3.	Trained group before the program	1	0	$\overline{y_{T0}} = a + b$
4.	Trained group after the program	1	1	$\overline{y_{T1}} = a + b + c + d$

So using Equation

Impact of the program = $((a+b+c+d)-(a+b)) - ((a+c)-a)) = d$

RESULTS AND DISCUSSION

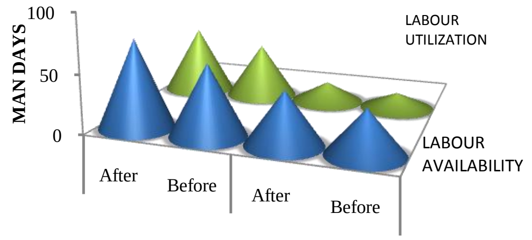
Impact on Employment Generation

The components of availability of family labour per household per month, utilization of labour for crop, livestock and non-farm activities under different land holding categories were presented in the Table. 3. On an average, labour availability per household in treatment group was 75 and 61 mandays during after and before implementation respectively. In the case of control group, labour availability per household was 45 and 37 mandays during after and before implementation respectively. Monthly labour utilization per household in treatment group was 57 and 47 mandays during after and before implementation respectively whereas in the control group, it was 17 and 14 mandays during after and before implementation respectively. From these two components, labour utilization percentage was worked out as 72.63 per cent for treatment group and 49.40 per cent for control group.

Table 3 Labour availability and labour utilization of households

Sl. No.	Particulars	Treatment		Control	
		After	Before	After	Before
1.	Monthly labour available per household (mandays)	75.13	60.56	44.96	37.39
2.	Monthly labour utilization per household (mandays)	57.09	46.51	17.48	13.74
3.	Labour utilization percentage	72.63		49.40	
	Changes in the Labour utilization	23.23			

FIGURE 1. LABOUR AVAILABILITY AND LABOUR UTILIZATION



It was analysed that the labour utilization percentage has been improved by 23.23 per cent in the households because of developmental activities which involved more labours. These watershed technologies increased the cropping pattern, cropping intensity, production and productivity levels and shifts the farming activities from less labour intensive to more labour intensive crops, livestock and other enterprises which in turn shift the labour absorption per hectare of cultivated area over control areas.

Migration

The contribution of migration to livelihoods will depend on various factors, including the seasonality of movement, the length of time spent away, assets and social structures and institutions. WSD involves the establishment of new institutions such as user groups and watershed committees. Migrants generally the poorest are often absent from villages and so tend to be marginalised from decisions on resource uses. In the context of WSD, seasonal migration is viewed as a negative phenomenon, largely on account of its exploitative nature and its disruptive effect on family life and wider social relations. The watershed programmes achieved good success in reducing the overall migration from rural to urban areas by providing additional employment opportunities to the farmers in the village itself.

Table 4 Regression results of Migration

Variables	Seasonal Migration		Permanent Migration	
	Coefficients	Standard Error	Coefficients	Standard Error
Intercept	2.40	0.10	2.09	0.11
δ	-0.89***	0.15	-0.84***	0.16
T	-0.60***	0.14	-0.44***	0.15
δT	-0.09	0.21	-0.14	0.23
Adjusted R Square	0.72		0.68	

***Significant at 1% level; * Significant at 10% level

From the results given in the Table4, it is clarified that both the seasonal and permanent migrations were significantly reduced due to watershed program in the watershed villages. The co-efficient of T (-0.60) is reduced significantly in both case of seasonal (-0.60) and permanent (-0.44) migrations. Great decline was noticed in seasonal as well as permanent migration of the farmers because of watershed programmers as the co-efficient of δT expressing the reduced level of seasonal (-0.09) and permanent (-0.14) migration. However, a sharp decline was noticed in all categories of farmers in the long-term migration as compared to seasonal migration. The data also suggests that the seasonal as well as permanent migration of skilled labor in all categories of farmers were more reduced as against to the unskilled labor. Overall, the adjusted R^2 is worked out to 0.72 for seasonal migration and 0.68 for permanent migration indicating 72 per cent and 68 per cent of the variations were explained by the explanatory variables respectively. The present study revealed that with active participative management by the farmers in the watershed development programmes, they can reap much greater benefits on a continuous basis. The data also suggests that the seasonal as well as long-term migration of skilled labor in all categories of farmers were more reduced as against to the unskilled labor. Interestingly, the percentage of reduction of migration was lower in case of marginal and small holding farmers as compared to medium and large landholder farmers.

CONCLUSION

The integrated watershed management program at the Coimbatore district made significant positive impact on effective labour utilization which reduced the migration behavior of the community, hence, improved the rural livelihoods security. The watershed program also increased the income and reduced poverty of people in the watershed. The farmers got relatively greater benefits from the watershed activities. It increased the working days of all categories of farmer; and achieved good success in reducing the seasonal as well as permanent migration from rural to urban areas by providing better employment opportunities to farmers within the village itself.

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