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Impact of Technology Intervention on Fish Productivity and Profitability of Fish Farming in South Tripura

Biswajit Debnath[1]*

Krishi Vigyan Kendra (ICAR for NEH Region), South Tripura
Birchandra Manu, P.O. Manpathar, South Tripura – 799 144.

ABSTRACT

Impact of fisheries technology intervention by Krishi Vigyan Kendra (KVK), South Tripura was assessed in terms of fish productivity and profitability in the intervened villages of the district. The study prepared the model of 'Difference in differences' (DiD) estimator in a regression framework to estimate the changes in dependent variables. Non-random longitudinal data collected from 68 farmers (categorized as beneficiary: 33 nos. and non-beneficiary: 35 nos.) were used to estimate the DiD model for both fish productivity and profitability within the time passage of 2014 to 2018. Regression model framework estimated the non-standardized DiD coefficients as 124 and 5460 for productivity and profitability model respectively. It implies that the expected mean change in the fish production and profitability of beneficiary farmers (treatment group) was 124 kg/ acre/ yr and Rs. 5460 per acre/ year respectively due to technological intervention over the mentioned time passage after due consideration towards the same among non-beneficiary farmers (control group). Overall, the study concluded a positive impact of fisheries technology intervention of KVK, south Tripura on fish productivity and profitability in the district during 2014 to 2018.

Key Words: Difference in differences, Fish productivity, Impact study, Krishi Vigyan Kendra, Profitability of fish farming.

INTRODUCTION

Technological intervention on agriculture and allied sectors through trainings, demonstrations and other extension activities is prime component of frontline extension system in our country. Krishi Vigyan Kendra (KVK), an initiative by Indian Council of Agricultural Research (ICAR) has established a network of more than 718 KVKs in the country aiming at assessment and demonstration of technologies/ products and its dissemination through number of extension programmes to increase the productivity and profitability. The impact of technological intervention made by KVKs in our country is a matter of research interest and it is considered to be an important component for policy decisions. Chander (2015) reported that the training programmes conducted by KVKs on improved technologies related to agriculture and allied fields benefited the farmers in terms of increased crop production and improved farm income. The effectiveness of technology intervention is reflected by the impact on farm productivity, profitability, income, and livelihood status of rural farming community. Nevertheless, there is currently an abundance of documents related to adoption of the technology, impact of different extension programmes etc.A study by Islam and Haque (2010) on 'impacts of Northwest Fisheries Extension Project (NFEP) on pond fish farming in improving livelihood approach' found that 92.5% of farmers improved their socio-economic conditions through carp farming because they practiced aquaculture according to the instructions of NFEP project. Agbebi (2012) carried out a study on impact assessment of extension services on fish farming in Ekiti State, Nigeria to investigate the socioeconomic

*Corresponding Author's E-mail: debnath_biswajit@rediffmail.com

characteristics of fish farmers including farmers' profitability. Agricultural productivity is one of the key determinants of agricultural growth (Salami, 2010) and Aquaculture has the same objective as agriculture, namely, to increase the production of food above the level that would be produced naturally.

Among all the agricultural sectors, fisheries sector is one of the vital sectors for economic development in south Tripura district of Tripura state in North East India (Department of Fisheries, Government of Tripura, 2016). High annual per capita fish consumption and huge demand of fish made the sector as a potential sector for income generation and livelihood development of the state (Debnath *et al*, 2012). Fish farmers of the State in general have come to believe that fish farming is a profitable activity under agriculture & allied sectors (DES, Government of Tripura, 2016). Realizing the importance of impact assessment of KVK's technology intervention at field level, this study attempted to analyze the impact of technology intervention on fish productivity and profitability of pond fish farming in south Tripura district.

MATERIALS AND METHODS

The present study is mainly based on longitudinal primary data collection from the fish farmers of six different villages in south Tripura district where KVK, South Tripura has made scientific interventions during April, 2014 to March, 2018. The data on fish productivity and profitability during March, 2018 was collected through a survey of those farmers conducted during April to August, 2018. Pre-technology intervention survey that was conducted during 2014 covered 68 Farmers of which 33 nos. of farmers were selected randomly for receiving technology guidance of KVK, south Tripura till 2018 in terms of training, demonstration and other extension activities. The sampling was not random and the farmers who have received the technology guidance were categorized under beneficiary group and who have not received the same was categorized under non-beneficiary group. The data on fish productivity (kg per acre per year) and profitability of fish farming (as net income in terms of Rs. per acre per year) were consideredfor both groups of farmers.

Analytical method:

This study usedthe 'Difference in Differences' Estimator (DiD Estimator) in a regression framework as used by Card & Krueger (1994). DiD is used in many applied studies to identify the causal difference between two treatments. Havnes and Mogstad (2011) used DiD to estimate the development of a more affected group by analyzing development of a group that is less affected. The outcome (in terms of either productivity or profitability) of Yi is modelled by following equation:

$$Y_i = \alpha + \beta F_i + \gamma T_i + \delta (F_i * T_i) + \varepsilon_i \quad \ldots\ldots (1)$$

Where,

Yi = Outcome

α = Constant term

β = Specific effect on group of farmers received technology intervention (to account for average permanent differences between intervention and control)

γ = Period trend (April, 2014 and March, 2018) common to farmers group under technology intervention and control group

δ = True effect of the technology intervention

The purpose of impact evaluation due to technology intervention is to find a good estimate of δ (i.e. diff in diff, DiD estimate) with the dataset collected through survey.

The Difference in Difference Estimator (DiD)

The difference in difference (or 'double difference') estimator is defined as the difference in average outcome in the treatment group before and after treatment minus the difference in average outcome in the control group before and after treatment: it is literally a 'difference of differences'. Table 1 explains the DiD estimator more simpler way along with the constant term (α) and co-

Table1: Explanation of constant term (α) and co-efficient term (β, γ, and δ) of outcome

	Before technology intervention (during April, 2014)	**After technology intervention (during March, 2018)**	**Differences**
Beneficiary farmers group (Treatment)	α Expected average outcome	α + γ Expected average outcome	γ Differences =
Non-beneficiary farmers group (Control)	α + β Expected average outcome	α + β + γ + δ Expected average outcome	γ + δ Differences =
	Difference in Difference (DiD)		δ

efficient term (β, γ, and δ) of the model mentioned in equation (1).

The outcome of the technology intervention has been estimated for fish productivity (noted as 'Prd') and profitability of fish farming (noted as 'Prt') separately. The model based on above explanation on DiD used for present study could be stated as follows:

$$Y_i^{Prd} = \alpha^{prd} + \beta^{prd} F_i^{prd} + \gamma^{prd} T_i^{prd} + \delta^{prd} (F_i^{prd} * T_i^{prd}) + \varepsilon_i^{Prd} \text{.........}(2)$$

$$Y_i^{Prt} = \alpha^{prt} + \beta^{prt} F_i^{prt} + \gamma^{prt} T_i^{prt} + \delta^{prt} (F_i^{prt} * T_i^{prt}) + \varepsilon_i^{Prt} \text{..........}(3)$$

Here, the notations used above are similar as explained in the equation (1), whereas the equation (2) and (3) have been modelled for fish productivity (prd) and profitability (prt) of fish farming respectively. Present study attempted to evaluate the impact of technology intervention by finding a good estimate of δ (i.e. diff in diff, DiD estimate:and).

RESULTS AND DISCUSSION

The results of difference in difference estimator (DiD Estimator) in a regression framework to evaluate the impact of technology intervention on fish productivity and profitability of fish farming was carried out using SPSS Statistics 21 software. The regression framework was estimated to test the null hypothesis that nothing changed in fish productivity and profitability of farming from April, 2014 to March. 2018 due to fisheries technological intervention made by KVK, South Tripura in either group (beneficiary and non-beneficiary farmers) and both groups had the same expected outcomes at baseline. Both the regression framework (outcomes in terms of fish production and profitability regression) showed a significant F-value as mentioned in Table 2. The R-squared and adjusted R-squared value for both the regression was 0.612 and 0.627 for regression of fish production and profitability respectively.

Table 3 and 4 showed the estimated coefficient and result of model estimation for fish production and productivity respectively. The coefficient of the technology intervention variable and is the estimated mean difference in fish productivity and productivity (respectively) between the beneficiary and non-beneficiary farmers group prior to the technology intervention. The unstandardized estimated coefficient for technology intervention variable was 26.590 (with standardized estimated coefficient 0.133) indicates that the estimated mean difference in fish productivity between the beneficiary and non-beneficiary farmers group were 26.590 kg/ acre/ yr which was significant at 5% level

Table 2: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig
Productivity (prd)	0.793	0.629	0.612	62.85729	36.153	< 0.001
Profitability (prt)	0.802	0.643	0.627	2789.29634	38.465	< 0.001

(but not at 1 % level). The same unstandardized estimated coefficient for profitability model was 1676.186 (with standardized estimated coefficient 0.185) which indicates that the estimated mean difference in profitability of fish farming between the beneficiary and non-beneficiary farmers group were 1676.186 kg/ acre/ yr . This difference in expected mean value of fish productivity and profitability among two groups of farmers may be due to the fact that the selection of the farmers for fish farming technology intervention was a bit biased towards the farmers with better fish farming performance during initial period. But still we can conclude that the baseline differences in fish productivity and profitability between the beneficiary and non-beneficiary farmers group was considerably low and it was not highly significant.

Interestingly, the coefficient of time (period) variable and which implies the expected mean change in the fish productivity and profitability (respectively) during April, 2014 to March, 2018 among the non-beneficiary farmers group only was found significant at 1 % level. The unstandardized estimated coefficient for time (period) variable was 54.953 (with estimated standardized coefficient 0.274) indicating a change in expected mean value of fish productivity by 54.953 kg/ acre/ yr, which is a pure effect of the passage of time without the fisheries technological intervention by KVK, South Tripura. The same unstandardized estimated coefficient for profitability model was 2374.506 (with standardized estimated coefficient 0.262) whichindicate the estimated mean difference in profitability over the time passage among the non-beneficiary farmers group were 2374.506 kg/ acre/ yr. This difference in expected mean value fish productivity and profitability over passage of time among the non-beneficiary farmers groupmay be due to the demonstration effect of the technology intervention among the non-beneficiary farmers. This change may also be due to the other extension services provided by different stakeholder on fish farming among the non-beneficiary farmers.

The coefficient of interactive variable is the Difference in Difference (DiD) estimator i.e. and for the fish productivity and profitability model respectively. It is the focus of interest for the estimation of which we constructed the regression model. It is the reflection of actual level of impact received in terms of fish productivity and profitability during 2018due to technology intervention initiated by KVK, South Tripura during 2014. It is the hallmark of the fisheries technological intervention made by KVK, South Tripura. The DiD estimator i.e. the co-efficient (unstandardized) of interactive variable for fish production was found 123.780 and the same for profitability in fish farming was found 5459.999. It implies that the expected mean change in the fish production and profitability in fish farming was 123.780 kg/ acre/ yr and Rs. 5460 per acre/ year respectively due to technological intervention over the passage of period from 2014 to 2018 after subtracting the expected mean change among the non-beneficiary or control group of farmers.

Results showed the impact of fisheries technology intervention in terms of productivity and profitability of fish farming by KVK in south Tripura district and hence, an effective extension approaches towards the income generation of rural farmers in the district. Agricultural extension remain one of the most crucial and critical means to reach farming households in the rural areas (Adekunle, 2013). Al-Sharafat *et al* (2012) explained that

Table 3: Estimation of model (fish productivity) and its coefficients

Model: Productivity as dependent variable	Unstandardized Coefficients		Standardized Coefficients	t - value	Significance
	Estimated Coefficients	Std. Error			
Constant (α)	575.441	15.245		37.746	0.000
Farmers (β)	26.590	21.894	0.133	1.214	0.229
Period (γ)	54.953	21.258	0.274	2.585	0.012
Farmers × Period (δ)	123.780	30.517	0.535	4.056	0.000

Table 4: Estimation of model (profitability of fish farming) and its coefficients

Model: Profitability as dependent variable	Unstandardized Coefficients		Standardized Coefficients	t - value	Significance
	Estimated Coefficients	Std. Error			
Constant (α)	19852.721	676.504		29.346	0.000
Farmers (β)	1676.186	971.555	0.185	1.725	0.089
Period (γ)	2374.506	943.339	0.262	2.517	0.014
Farmers × Period (δ)	5459.999	1354.181	0.522	4.032	0.000

extension starts with knowledge management and ends up withhuman enrichment.

CONCLUSION

The study showed that there was a positive impact of technology intervention by KVK, South Tripura on fish productivity and profitability of fish farming in the district. Fish productivity and profitability in fish farming of the farmers who received the technology guidance from KVK, South Tripura had an average mean increment of 124 kg per acre per year and Rs. 5460 per acre per year in terms of productivity and profitability during the passage of time from 2014 to 2018.

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