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Impact of Agricultural Extension Institutions on Farm Efficiency among Rice Farmers in Kerala, India

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ABSTRACT

This study assesses the role of agricultural extension institutions in improving efficiency of rice production in Kerala, India. Data were collected through a primary survey of 72 purposively selected rice farmers. Three major extension institutions were identified. Satisfaction of farmers from extension was measured using principal component analysis and technical efficiency through Stochastic Frontier Analysis. Satisfaction scores were poor. However, extension services were found to be significantly contributing to technical efficiency of rice production. Efficiency of extension services could be improved through reforms in the current institutional structure.

Keywords: *Agricultural extension; Rice farming; Technical Efficiency; Satisfaction; Principal Component Analysis; Stochastic Frontier Analysis; Kerala*

INTRODUCTION

Over years, the concept of agricultural extension had undergone several changes. Agricultural extension is a process with the purpose of transferring information generated out of research from regional, national and international levels to farmers (Norton et al. 2020). Traditionally, extension is perceived as a short term programme with short term goals including farm visit, field visit etc (Davis et al. 2020). But nowadays extension is viewed as a continuous long term problem solving process. It is a process that can influence the behavior of its recipients and thereby influence decision making and production process. Extension services are not supposed to be simply an information and technology transfer process as perceived in the past. It is intended to bring effective changes through development of knowledge, attitude and skills through advisory and information delivery services (Sulandjari et al. 2021). Extension services are found to help bring improvement in agricultural productivity (Sharifzadeh et al., 2021). Thus the widening conceptual scope of extension activities can contribute a lot to agricultural development. But these conceptual goals are often not in terms with reality. Lack of responsiveness of extension agents, poor management of extension

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programmes, lack of support from farmers, centralized mode of extension delivery, lack of region specific programmes, poor coordination between farmers, local and central officials, poor on farm research and low budgeting along with poor research funding for extension are cited as reasons for poor performance of extension activity (Albore, 2018; Gulati et al., 2022),

Rice is the staple food crop of people of Kerala but has only 0.43 percent of national area under Rice cultivation (13th position). During 1955-56 rice was cultivated in an area of 7.59 lakh hectares in Kerala. By 1974-75, it increased to 8.81 Lakh hectares. Thereafter, area under rice in the state declined gradually reaching 2.02 lakh hectares in 2020-21 (Government of Kerala, 2021). The reason for this decline are many including converting land for other purposes, loss of soil fertility, pest diseases attack, climatic changes etc. Food grains produced in the state account for only 15 percent of its total consumption demand (Government of Kerala, 2021). With declining production and productivity and increasing consumption demand food security is under threat. With shortage of agricultural land, the area under rice production can't be increased. Factors like effective extension services will help farmers make better production decisions given the existing constraints.

In Kerala, the frequency of extension services and availability of extension staff is relatively low. In general, extension agents are not trained in providing extension services using ICT tools like mobile phone (Sebastian et al., 2019). Extension programmes like ATMA are reported to be inefficient in transferring information to farmers (Vijayakumar, 2019). Given this, mere existence of extension programmes alone is not sufficient. These programmes should be efficient to address the challenges of farming sector (Mgendi et al., 2021).

The effectiveness of extension services in general (Rivera et al., 2022) and effectiveness and impact of specific extension programmes like Training and Visit system, Village aid programmes, integrated rice development programmes (Baloch et al., 2019), ATMA (Agricultural Technology Management Agency), LEADS (Lead Farmer Centered Advisory Delivery Service) etc had been discussed in the previous literature (Vijayakumar, 2019). But there are also institutions involved in providing extension services- local government institutions, and private agents. These are the institutions that connect specific extension programmes to farmers, but specific studies were not designed to identify them, list out their services, analyze their impact and measure the satisfaction of farmers from these services etc. The economic impact of agricultural extension was measured using productivity (yield) changes or by measuring the extent of technology adoption by farmers (Takahashi et al., 2019).But how

extension services impact technical efficiency of agricultural production have not been widely discussed.

This study therefore tries to focus on these two research gaps. Thus the objective of this study is to measure the role of agricultural extension institutions in technical efficiency of production by focusing on the rice farmers of Kerala, India.

METHODOLOGY

Alappuzha district is one of the major rice producing districts in Kerala with 32 per cent of the rice produced in Kerala coming from the District (Government of Kerala, 2021). The declining soil fertility, increasing pest disease attack, increasing use of chemical pesticides, huge losses from changing weather conditions put huge stress on the rice yield in the district (Government of Kerala, 2021). As extension services are meant to help farmers address the emerging challenges in production, an analysis of how the current extension system in rice in the district works is significant. In total Alappuzha district has 24, 864 rice farmers (Data source: Principal Agricultural Office, Alappuzha). Participants of the study were identified from Rice producing households of *Padashekharam's* (or farmer organization) a large group of rice fields organized together) of *Kainakary* and *Thakazhi* Krishi Bhavans of Alappuzha District. These 2 Krishi Bhavans were selected because they contain largest area under rice cultivation (3213.64 hectares in Kainakary and 1725.86 hectares in Thakazhi) (Data source: Principal Agricultural Office, Alappuzha).

Out of the total 24,864 rice farmers, 4176 (16.8 per cent) belong to Kainakary and 2314 (9.3 per cent) belong to Thakazhi area. The samples were purposively selected to identify rice farmers who get extension services from the 3 identified extension institutions in the district. The criteria of selection were that, the sample farmer should be the one who gets extension services from these institutions at least once in a week. While purposively selecting the samples, more samples were selected from Kainakary area (46 farmers) as it contains higher proportion of farmers and 26 farmers from Thakazhi area were selected resulting in a total sample of 72 rice farmers. Study was based on primary data collected using a semi structured interview schedule. Study was conducted from1st December 2021 to 31st December 2021 and from1st December 2022 to 31st December 2022. But for maintaining uniformity and accuracy of analysis, data on Yield, land size and other input cost were collected for the harvest season of November- December 2021.

In this study context, extension refers to information and advisory delivery services that help farmers understand their constraints and find possible solutions to it

so as to improve production, productivity and income (Davis, 2020). And technical efficiency refers to efficiency of inputs to create more outputs. Satisfaction of farmers from extension services was analyzed using a 5 point Likert scale analysis (1= very dissatisfied and 5= very satisfied) (Azumah, 2018). Farmers were asked to provide satisfaction score for each category of extension services provided by the identified institutions.

Using Descriptive analysis the institutions that provide extension in rice in the study area were identified along with types of extension activities provided by each institute. The role of extension institutions in efficiency of production was measured in two parts.The first part of the study focused on the analysis of satisfaction scores of farmers regarding the extension services they receive. Principal Component analysis was used for getting satisfaction scores. This methodology was used for extracting the factors that have significant impact on the dependent variable that is, value of production (Saithong et al., 2022).

The second part of the study measured technical efficiency of rice production in the study area and factors affecting technical efficiency of production. Stochastic frontier production analysis was used for technical efficiency analysis (Ogaraku et al. 2020). A production function was described initially. The value of the rice production per acre (quantity multiplied by price per quintal) in the year 2021 (Harvest season November- December 2021) was taken as the dependent variable. Four independent variables included in the production function were size of land (in acres), production cost (including cost of all inputs- land, labor, machinery and other material inputs in rupees), years of experience in rice farming and frequency of extension services received (number of days per month).

An analysis of constraints in extension availability was also done using primary survey.The constraints were identified and modified from the variables identified from previous studies (Takahashi et al., 2020; Gulati et al., 2022) Farmers were asked to rank the constraints on a scale of one to five. These scores were used for providing justification to satisfaction scores.

FINDINGS AND DISCUSSION

Extension Institutions and Services

The study identified the major institutions that provide extension services in rice production in the study area. It was found that there were three institutions that provide extension services in Rice: *Krishi Bhavans*, Rice Research Stations and Farmer organizations

Krishi Bhavans are local Government Body under Department of Agriculture that deals with the creation and implementation

of various programmes for the development of Agricultural sector. Rice research stations are part of Kerala Agricultural University which mainly focuses on research activities including production of new seed varieties, technology etc. But they also provide extension services to rice farmers in Kerala. Farmer organizations are base level organizations that contain a group of farmers of a group of paddy fields. The organizations also called as *Padashekhara Samitis* have a proper organizational structure with a President and Secretary. The organization serves as a connecting link between farmers and all other extension institutions. With respect to rice there are four major extension activities: Plant and soil health services, Fertilizer and pesticide application, Pest disease identification and solution and Climatic/ weather information. Information in these areas are provided through field visits, farm visits, office visits by farmers, through phone calls, Whatsapp groups, notices, Advertisements, meetings, seminars and farmer-to-farmer communications.

Farmer Satisfaction Regarding Services from Agricultural Extension Institutions

Table 1 shows the results of satisfaction scores of farmers for each extension activity analyzed using Principal component analysis.

Table 1: Farmer Satisfaction Scores (for each extension activity) using Principal Component Analysis

Institution	Extension Services Offered	Satisfaction Scores Indicated by Principal Components (Sample size, n=70)				
		C1	C 2	C 3	C 4	C 5
Krishi Bhavan	Plant and soil health	.254	.226	.038	.093	-.005
Krishi Bhavan	Pest and diseases	.212	.295	.094	.045	-.054
Farmer organization	Plant and soil health	.112	-.223	.393	.152	-.032
Farmer organization	Fertilizer	.064	-.218	.390	-.242	.229
Krishi Bhavan	Climatic information	-.196	.184	.347	-.118	-.172
Research Station	Pest and diseases	-.247	.113	.256	.136	-.044
Farmer organization	Climatic information	-.025	-.290	.248	.454	.254
Krishi Bhavan	Fertilizer	.135	-.298	-.222	.340	-.193

Institution	Extension Services Offered	Satisfaction Scores Indicated by Principal Components (Sample size, n=70)				
		C1	C 2	C 3	C 4	C 5
Research Station	Fertilizer	.088	.240	.181	.482	-.215
Farmer organization	Pest and diseases	-.095	.279	-.056	.363	.487
Research Station	Plant and soil health	-.152	-.067	-.260	.229	.295
Research Station	Climatic information	.150	.073	.056	-.215	.663
Percentage of variance		27.20	13.87	11.57	9.17	8.34
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.					0.630	
Significance (Bartlett's Test of Sphericity)					0.000	
Source: *Primary Survey among rice farmers using interview schedule*						

70.1 % of the variation in the observation was explained by the first four principal components, extracted out of 12 independent variables using principal component analysis. Hence satisfaction scores were derived using these 5 principal components. Table 1 shows that farmers get the highest satisfaction from extension services related to climatic information services (0.663) provided by the Research stations. Extension services provided by farmer organizations had the highest satisfaction score (0.487) regarding pest disease identification and solution. In extension services related to plant and soil health services also, farmer organization satisfied farmers more (0.393). Extension services of the Research station provided more satisfaction to farmers regarding Fertilizer and pesticide application.

Of the three major institutions that provide extension services to farmers, extension activity by research station was most effective in satisfying farmers. It had satisfaction scores of 0.295, 0.256, 0.482, and 0.663 for extension services related to plant and soil health, Pest disease identification and solution, Fertilizer and pesticide application, and climatic information, respectively. *Krishi Bhavan* was the least effective, with a satisfaction score of 0.254, 0.295, 0.340, and 0.347 for extension services related to plant and soil health, Pest disease identification and solution, Fertilizer and pesticide application, and climatic information. Farmer organization had Satisfaction scores of 0.393, 0.487, 0.390, and 0.454 for extension services related to plant and soil health, Pest disease identification and solution, Fertilizer and pesticide application, and climatic information. These scores indicate that the Farmer organization is the next best option for farmers after the

rice research station to get extension services.

It can be inferred that farmers were not fully satisfied by the extension services provided by these three major institutions. Table 2 helps in understanding the reasons for farmer dissatisfaction. From the interview, the constraints in extension service availability were identified. Farmers were asked to rank each constraint on a scale of 1-5 and average rank was calculated (1= least severe, 5= most severe).

Table 2: Ranking of Constraints faced in getting Extension Services

Sl.No.	Constraints	Average Rank (Sample size, n=70)
1	Lack of frequent extension services in the area	3.2
2	Inadequate number of extension agents	4.2
3	Lack of awareness of information sources	3.7
4	Information not easily accessible	3.8
5	Poor knowledge-sharing culture	4.1
6	Lack of information provision in time	4.8

The major reason for dissatisfaction of farmers regarding extension services were lack of information availability on time (4.8- highly severe). According to the respondent's information on soil fertility, weather changes etc were given very late, so that they won't get enough time to prepare. Classes and seminars were there, but not when farmers need it. There was lack of early prediction of pest disease attack. This makes information, even if it is available, less useful to farmers. Farmers were not able to find adequate solutions to their agrarian problems due to Lack of frequent extension services and inadequate number of extension agents. There was also difficulty in accessing information as farmers often have to go to these offices or institutions to get information services. Considering travelling difficulties (costing time and money) farmers become reluctant to visit these institutions or become part of farmer organizations meeting. Along with all these issues poor communication among rice farmers had resulted in less diffusion of information.

Role of Agricultural Extension on Technical Efficiency of Rice Production

The stochastic frontier approach was used for measuring technical efficiency. Table 3 shows the results of Stochastic frontier analysis performed using Frontier

(Version 4.1) software with trans log production function for the analysis of technical efficiency. The study made use of the following form of production function:

$$L_n(Y)= \beta_0 + \beta_1 L_n X_1 + \beta_2 L_n X_2 + \beta_3 L_n X_3 + \beta_4 L_n X_4 + V_n$$

Where Y is Value of production per acre (in rupees), X_1 is Size of land (in acre), X_2 is Cost of production (including cost of all inputs- land, labor, machinery and other material inputs in rupees), X_3 is Years of experience in rice farming, X_4 isFrequency of extension services received (number of days per month) and V_n is the Error term

Table 3: Maximum Likelihood Estimates of the Stochastic Frontier Analysis for the Study area

Variables and Parameters	ML Estimates (Sample size, n=70)		
	Coefficient	Standard error	t-ratio
Constant	-0.512	0.516	-0.993
Size of land	-0.0496	0.132	-0.376
Input cost	0.0541	0.133	0.407
Experience in rice farming	0.519	0.202	2.57**
Extension	0.878	0.070	12.46**
Sigma	0.802	0.387	2.070*
Gamma	0.613	0.403	1.521
LR test	0.312		
Log likelihood function	-74.027		
**Statistically significant at 1 percent			
*Statistically significant at 5 percent			
Source: *Primary Survey among rice farmers using interview schedule*			

From Table 3, it can be observed that elasticity of the variable associated with extension service frequency is positive and highly significant. Hence, if the frequency of extension services increase by 1 per cent, it would increase agricultural production by 0.878 percent. This indicates the significance of extension services and its frequency in improving agricultural production. The variable indicating the experience of farmers (years of experience in rice farming) also has positive elasticity and is significant. With increase in the years of experience farmers improve their production efficiency. The input cost variable is positive but not statistically significant. The elasticity of size of land is negative and not significant. The constant

term is not significant (-0.993) which shows that the omitted variables in the study are not significantly affecting technical efficiency.

The gamma value (γ) of the Maximum likelihood estimate of the Stochastic Frontier Production model is 0.613. This value is statistically not significant. From this it can be inferred that 61.3 percent of the variability of agricultural production is related to the factors contributing to the technical efficiency of agricultural production. The rest of the variability (38.7 per cent), is due to random noises. The Likelihood ratio test (LR Test) was used to measure the presence of technical inefficiency (Table 3). It gave a value of 0.312 which is less than the critical chi square value 12.483 (given by Kodde & Palm, 1986). Therefore the null hypotheses that there is no technical inefficiency can be accepted. The production technique is efficient. Size of land and input cost or production cost has nothing to contribute to improve technical efficiency. If technical efficiency of production has to be improved the frequency of extension services should be improved.

CONCLUSION

The study analyzed the role of agricultural extension services on technical efficiency of rice production in Kerala, India. The major inference was that extension services contribute significantly in improving technical efficiency of rice production in the study area. Factors like land size and input cost were not contributing to technical efficiency. But apart from the satisfaction regarding a few services provided by Research station, farmers were dissatisfied from the extension activities. The reason for this were lack of timely information provision, lack of extension staff, less frequent availability of services and poor cooperation and communication among farmers.

Thus the policy suggestion is to bring reforms in the current extension structure. *Krishi Bhavans* should improve the quality and frequency of extension services delivered. There should be separate extension officers who should be given the task of effective transferring of information. Research stations must be free from the double burden of research and extension and focus only on research. The farmer organizations should be more active to improve communication among farmers and between farmers and these institutions. An improved institutional environment of extension will definitely contribute to improve production, productivity and thereby improve farm income.

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