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ANALYZING THE TECHNICAL EFFICIENCY OF FARMERS GROWING DIFFERENT CROPS IN DISTRICT MANSEHRA, PAKISTAN

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Abstract

The agriculture sector of Pakistan is characterized by unsustainable traditional practices and inefficiency in farming. Appropriate ways to increase productivity and efficiency are therefore, essential for individual households' welfare and the country's economy. Thus, this study aims to analyze and estimate the factors affecting the technical efficiency and to identify the level of satisfaction of farmers on their cultivation experiences in District Mansehra, Pakistan. An aggregate sample of 96 farmers and four government officials were interviewed, using the purposive sampling technique. A stochastic frontier production function was used to evaluate the technical efficiency, using Frontier 4.1 for its utility in inefficiency estimations. While, average technical efficiency of the selected crops i.e potato, onion and tomato was estimated79%, 74%, and 69%, respectively, indicating space for improvement in efficiency by 21%, 26%, and 31% by effective usage of available resources. This indicates that using proper amounts of fertilizer, agrochemicals, seeds, labor, and machinery could increase the production of crops and the efficiency, of farmers that are intervening near to the frontier level of efficiency.

Key words*: *technical efficiency, crop production, Stochastic Frontier Function, Mansehra, Pakistan

INTRODUCTION

Agriculture being an essential and beneficial economic activity, is one of the main sectors for the economic development of Pakistan [19]. Agriculture plays an important role in eradicating poverty, ensuring security of food, and bolstering the economy [17]. The agriculture sector is responsible for around 19% of the total gross domestic product (GDP) and employs around 42% of the country's labor force. Approximately 62–64% of the population lives in rural areas, agriculture being their only source of income [18]. Due to the strong links of agriculture and economic development, a developed and profitable agricultural sector can improve the lives of rural communities [18]. Unfortunately, the agriculture sector in Pakistan is not as productive as expected, hampered by several factors that threaten the overall sustainability of agricultural production of the country [22]. The contribution of this sector to the total national production has declined over time by one hundred percent, from 42 percent in the seventies to 21 percent in recent past [8].

There are many reasons for the decline of the sector. The major constraints to agricultural productivity of Pakistan are the ever-increasing population stress in addition to the dominant use of conventional agricultural practices, including outdated farm tools, traditional technology, low usage of latest inputs like seeds and fertilizers, low pace for agriculture extension services and changes in cropping patterns [30]. Such obstacles make the agriculture sector less productive and beneficial, which in turn results in low levels of income for the people engaged in the sector. The repercussions of these problems have devastating impacts on productivity, which in turn affects the farmer's quality of life [10].

A major cause for low growth output, according to Arshad and Shafqat [9], is the low literacy rate of majority of the farmers coupled with the lack of physical capital, creating a lack of ability to understand and employ the latest technologies and inputs. A significant expansion in production output can result from incremental changes to the efficiency of production. Hence, it is important to analyze how the inputs of existing resources are being utilized and what probabilities exist to improve the efficiency of productivity, considering the resource constraints.

Gains in productivity through advancement of efficiency levels are especially significant. Thus, measures of efficiency are computed by comparing observed performance with a specified standard [11]. The efficiency of a farm can be measured in terms of allocative efficiency and technical efficiency (TE). In this study, we focus on the latter (i.e., TE). Shanmugam and Venkataramani [28] briefly define TE as *"the ratio between actual and potential output of a production unit"*. The chances of improving agricultural production by expanding the usage of technology have been decreasing. Thus, reducing existing inefficiency of farmers can end up being more cost effective than presenting new technologies for expanding agricultural output and farmer's income [15]. Determination of levels of efficiency and factors responsible are thus of vital importance for improvement in productivity in all production systems [4].

In most of developing countries including Pakistan, conventional agricultural systems are predominant. Typically, farmers are poor and have large family sizes with lower productivity output and a higher commodity demand to meet. Pressure from an increasing population coupled with land scarcity along with a decline in productivity [7] has made it difficult to keep pace with the increasing demand. This forces the farmers either to adopt the latest technological advancements or to effectively utilize the resources to enhance output. Due to the unavailability of resources and technological advancements, currently more importance is attached to the use of already existing resources, which can be determined by efficiency measurements [1]. Thus, to increase the output of crop production producers need a sound knowledge of the prevailing inefficiency level along with the factors responsible for this level of inefficiency.

Despite the capacity and potential of the study area in terms of agricultural productivity, it is not currently up to the mark. Thus, the requirement for the effective allocation of present productive resources is emphasized [13]. In areas with high inefficiency level, attempting to bring advancement in technology might not yield expected results, until the factors related to inefficiency levels among farmers are identified and followed upon. It is therefore important to analyze the technical efficiency to find out determinants of production and to identify farm specific attributes associated with low production efficiency [16].

Technical efficiency is mostly evaluated by two methods: a parametric approach and a non-parametric approach. The parametric approach uses econometric techniques, whereas the non-parametric approach enables data evaluation through mathematical techniques, i.e. data envelopment analysis (DEA) [21]. Econometric techniques are known as stochastic, and these techniques differentiate the effect of random error from the effect of inefficiency. Non-parametric techniques combine the errors and are thus known as combination inefficiency.

Production function models are the building block models used in macroeconomics. These models link the relationship between the input and output [23, 25] and are specific functions that are extensively applied to express the relationship between more than one input to the output [3]. Accordingly, in this study stochastic frontier analysis (SFA) was used. The observed origination of SFA is the production frontier model, originally mapped out by Aigner et al., [2]. The econometrics of stochastic frontier analysis (SFA) provides techniques for modeling the frontier concept within a regression framework so that inefficiency can be estimated. The benefit of SFA is the prospect that it offers factors of productivity variation into parts, which have direct economic interpretations. The main role of SFA is to have an estimator for one of the constituents of agriculture production, the degree of technical efficiency [5]. Since this study is rooted in both economic and social perspective, thus the main objective of this study is to estimate the level of technical efficiency and to determine the factors affecting the technical efficiency of farmers in the study area along with the satisfaction level of farmers on their experience of cultivation.

MATERIALS AND METHODS

A quantitative approach was employed to gain a better understanding of the situation through providing in-depth detail about main causes, factor dimensions and status of technical efficiency and the framework in which the program is functioning.

Study Area and Sampling

Tanda and Bajna, two villages from District Mansehra were selected for this study. Both areas were selected for reason that these areas are considered important production zones in the District. District Mansehra in general is one of the very low-income districts in Khyber Pakhtunkhwa province of Pakistan [26]. Agriculture is the prominent source of livelihoods in the study area followed by livestock, rangelands and forest, and off-farm incomes generated by small businesses. District Mansehra has fertile land with plenty of water, with both irrigated and rain fed land areas. Wheat and maize are the most grown crops followed by vegetables such as tomatoes, potatoes, onions, spinach and peas along with other green vegetables. This particular area was selected for its lower levels of efficiency despite the favorable conditions of production including richness of soil and favorable climate.

The purposive sampling technique was employed to select a total of 100 respondents out of which 96 were farmers and 4 were the Government officials from agriculture departments and extension service providers.

Data Collection

Both primary and secondary data was collected for the study. A structured, pre-tested questionnaire was used for the collection of the primary data for the study. In person interviews were conducted with household heads to get an insight into the various aspects of production from the last one year. Information regarding inputs and outputs and production, was collected in monetary terms and utilized for productivity analysis. Data regarding farm inputs comprised of fertilizers, seeds, machinery, labor and irrigation information, whereas data concerning farm outputs included information on gross production.

Data related to the socio-economic characteristics of the farmers was also collected and analyzed. This included data on their age, literacy level, household size, farm size and farming experience etc. Although a large number of farmers grow a variety of crops in the area, this study focuses on tomato, potato and onion crops only. Total production of crops (assessed in Pakistani Rupees “Rs.”) was the dependent variable of the study. Crop inputs analyzed were fertilizers, agrochemicals, seeds (own or hybrid), hired labor, cost of mechanization and cost of transportation, and were expressed in terms of their aggregate values. This method was used to make up for the lack of crop data per unit area (kg/kanal), especially in the case of agrochemicals. Hired labor and the cost of machinery were measured in terms of their monetary value. This included data on machine rent as well as ploughing and threshing. Farmers mostly rely on borrowed traditional tools and equipment such as tractors and threshers.

Theoretical and analytical framework

The Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA) are two commonly used methods for productivity estimation in terms of productive efficiency and related determinants. They can be used for multi-inputs and one output or as in the case of DEA for multiple-input and multiple-output technologies of production, by using a nonparametric approach [24].

Considering the determining factors, the stochastic frontier production function was used in the study to assess the Technical Efficiency (TE) of the production of crops on the farms. According to Coelli [14] SFA is preferable than other production function models regarding agricultural production. Data is determined at both end measurements of errors, peculiarly in developing countries [27]. The SFA developed by Aigner *et al*., [2] was deemed appropriate for this study.

Considering the frontier production as the maximum output in relation to the given inputs, the analysis validates the relation among farm and threshold output.

The Cobb−Douglas model is used to fit the production function. The benefit of using the Cobb−Douglas production model and the reasons why it was employed in this study is that it allows the analysis of outputs to the different inputs used in the process of production [6]. If Yi is the true level of production, then:

$$Yi = f(Xi)\varepsilon i \ldots (1)$$

where: εi signifies dispersion from the perfect production ranging from zero to one. However it cannot be negative. If the value of εi is greater than zero, the output is presumed to be influenced by a random error.

The stochastic production frontier of Cobb-Douglas is:

$$ln\,\mathrm{Yi} = \beta\,\mathrm{o} + \sum_{j=1}^{x} \beta\,\mathrm{j}ln\mathrm{Xj} + \mathrm{vi} - \mathrm{ui} \quad \ldots (2)$$

where: ln denotes natural logarithm and Yi represents gross production of crop in PKRs of the *ith* farm. β_0 represents the intercept, whereas β1-7 depicts parameters of responses to be valued corresponding to each input (i=1, 2, 3, 7). X_1 is hired labor cost in Rs/kanal. Fertilizer cost is X_2 in Rs/ kanal, X_3 reflects agrochemical cost in Rs/kanal, X_4 is purchased seeds in Rs/kanal, X_5 is transportation cost Rs/ kanal, X_6 machinery cost in Rs/kanal and X_7 is the other costs applied in numbers for crop. In the other hand translog frontier model, j, k, m and n represent the seven different variables interact.

V_i is a two-sided error component and indicates differences in output because of circumstances beyond the farmer's control. It also captures the effects of measurement errors in the output variable and other statistical noise. σ_2, v and u_i are a non-negative random variable, assumed to be normally distributed with zero mean-variance, of technical inefficiency (TIE). In general the normal distribution of the output is supposed to be zero and should be independent. Whereas, the mean depict μ_i and variance σ^2. While, the μ_i is described as:

$$\mathrm{u_i} = \delta_o \sum_{n=1}^{7} \delta_{\mathrm{i}} \ln\mathrm{Z_{ni}} - \mathrm{u_i} \qquad (3)$$

In the equation above, μ_i denotes effects of inefficiency, δ_0 shows the intercept term and $\delta_{1\text{-}7}$ represents a parameter for the *ith* explanatory variable. $Z1$ denotes farm size in kanals; $Z2$ shows age of farmers in years; $Z3$ represents literacy level of the farmers in terms of (number of years in school); $Z4$ indicates the farming experience of farmers in years; $Z5$ represents usage of agricultural machinery; $Z6$ shows the role of agricultural credits or loans; $Z7$ is a variable for the extension services.

The Maximum Likelihood Estimates (MLE) indicated in the first three equations for all parameters of the stochastic frontier production model, was employed using the program FRONTIER 4.1 [6]. Further, the variance parameters were elaborated as follows:

$$\sigma^2 = \sigma_v^2 + \sigma_u^2 \qquad (4)$$

$$Y = \sigma_u^2 / \sigma^2 \qquad (5)$$

So that $0 \leq \gamma \geq 1$: The γ value ranges from 0 to 1 the values close to 1 representing that random component of the inefficiency effects has a significant contribution to the analysis of the production system. The technical efficiency of production of the *i*-th farmer (TE*i*) given the levels of inputs used is defined by:

$$TE_i = \exp(-U_i) \qquad (6)$$

The TE of a farmer ranges from 0 to 1 and is inversely related to the degree of technical inefficiency [28]. The TE is also calculated using FRONTIER 4.1, calculating the estimated ML of the dependent variable mentioned in the formula 6 that is for its provisional probability, given the observed value of (Vi-Ui). If Ui is equal to 0, the farm is technically efficient. When Ui is greater than 0, the production lies below the frontier, which means the farm is technically inefficient [12]. Technical inefficiency estimates are only possible if the inefficiencies are stochastic and follow a specific distribution [29].

RESULTS AND DISCUSSIONS

Analysis of socio-economic and demographic variables

The socio-economic/demographic features of targeted farmers are presented in Table 1. The average age of farmers is 45.5 years and the majority of farmers selected were household heads. The average literacy rate was found to be around 2.72 years. The results from Table 1a show that the average years of experience in the study area was 25.78 years. The distance to market was almost same for all the farmers from same village with an average of 17kms. The total land area possessed by each farmer varied considerably, as it is unevenly distributed with an average of 45.29 kanals. The mean family size of 5.98 was found in study area with an average of 1.71 persons earning per household.

Most of the farmers in the study area were part time farmers with some other source of off-farm income with an average income of 19,052 RPS/month.

Table 1. Demographic Variables of Farmers

Variables	Mean	SD	Min	Max
Age years)	45.5	7.7	26	65
Education (years)	2.7	3.6	0	14
Farming experience (years)	25.7	8.8	5	50
Distance between home and market (km)	16.9	2.4	15	20
Total land Area (kanal)	45.2	27.7	8	100
Plots (nos.)	5.7	2.1	1	9
Household Members (nos.)	5.9	2.1	3	17
Earning Members (nos.)	1.7	0.6	1	4
Off-farm Income (Pk. Rs.)	19,052	12,767	5,000	45,000

Source: Field Survey 2022-2023.

Analysis of Farm and Crop Specific variables

In the study area it was found that farmers use their production for self-consumption, income generation and to sustain their livelihood. Most farmers who cultivate for commercial purposes belong to the Union Council 'Tanda-Bajna'. Lower output of farmers can be attributed to aspects such as underdeveloped irrigation system, lack of infrastructure, use of traditional machinery and inputs, lack of cold storage rooms, improper utilization of pesticides and chemicals, lack of subsidies and incentives provided.

Table 2 shows eight different types of crops grown by farmers in the study area, however, as can be seen in the given table, vegetables such as tomato, potato and onion are the major cultivated crops. Results in Table 2 show that tomato crops are the highest cultivated vegetable followed by potato and onion. Whereas the rest of crops such as spinach, tinda (round gourd) and rice has significantly lower production. Wheat and maize are grown for the purpose of self-consumption. Vegetables including tomato, potato and onion are the cash crops of area that are grown for commercial purposes.

Table 2. Types of Crops Grown by Farmers in Study Area Unit (Frequency & Percentage)

Crops	Yes	No	Total (%)
Wheat	11	85	12
Tomato	96	0	100
Potato	90	6	94
Onion	84	12	87
Spinach	30	66	32
Rice	20	76	21
Maize	13	83	14
Tinda*	20	76	21

Note: *Tinda (round gourd)
Source: Field Survey 2022-2023.

Hypothesis Testing

Log-likelihood ratio test was employed to test the hypothesis on the validity and suitability of efficiency model. This test is defined as $\lambda = -2\,[\mathrm{Ln}\,(H_0) - \mathrm{Ln}\,(H_1)]$, where Ln ($H_0$) and Ln ($H_1$), where log likelihood values are attained from the running models (restricted/unrestricted respectively). Null hypothesis (i) identifies those effects of inefficiency were not stochastic. This was strongly rejected as per the results in Table 3.

Table 3. Likelihood Ratio Test

Null Hypothesis	Log Likelihood	LR Statistics	Critical value	Decision
Tomato				
$H_o: \gamma = 0$	107.10	13.11	12.15	Reject H_0
$H_o: \gamma = \delta_0 = \delta_1 \ldots \delta_7$	71.02	59.24	19.10	Reject H_0
$H_o: = \delta_0 = \delta_1 \ldots \delta_7$	77.19	66.85	8.78	Reject H_0
$H_o: = \delta_1 \ldots \delta_7$	68.82	73.25	13.04	Reject H_0
Potato				
$H_o: \gamma = 0$	139.13	14.18	10.89	Reject H_0
$H_o: \gamma = \delta_0 = \delta_1 \ldots \delta_7$	123.44	49.82	20.19	Reject H_0
$H_o: = \delta_0 = \delta_1 \ldots \delta_7$	114.18	44.50	7.89	Reject H_0
$H_o: = \delta_1 \ldots \delta_7$	105.89	64.20	12.87	Reject H_0
Onion				
$H_o: \gamma = 0$	105.20	16.45	13.75	Reject H_0
$H_o: \gamma = \delta_0 = \delta_1 \ldots \delta_7$	84.09	65.74	25.08	Reject H_0
$H_o: = \delta_0 = \delta_1 \ldots \delta_7$	77.18	58.68	10.09	Reject H_0
$H_o: = \delta_1 \ldots \delta_7$	69.74	73.25	18.07	Reject H_0

Source: Field Survey 2022-2023.

Hypothesis rejection means that the function for traditional mean response is not a suitable illustration for production function. Furthermore, the hypothesis of inefficiency effects being absent (i.e., $\gamma = \delta_0 = \delta_1 \ldots \delta_7$), are rejected at 5% significance level. This clarifies that an overwhelming number of farmers work lower than technically efficient frontier, which was output oriented. With respect to the error component, there is no farmer specific or constant effect, evident from the testing of the third hypothesis. As per the results, the inclusion of the null hypothesis is rejected. The fourth hypothesis test implies collective significance of the inefficiency determinants. It rejects null hypothesis and indicates that explanatory variables influence farm efficiency collectively. However, it may not be individually significant.

Stochastic Frontier Production Function Analysis of Determinants of Productivity and Technical Efficiency of Each Crop

The general technical inefficiency impacts are assessed as far as the boundaries related with σ2 and γ parameters. The gauge for the change in σ parameter is fundamentally not quite the same as zero at 1%. This demonstrates measurable affirmation of our assumption that there are contrasts in technical efficiency. These outcomes show that the impacts of technical efficiency are significant in the production process. The assessed value for the variance of γ parameter is huge at 1%, which shows that the arbitrary part of the inefficiency impacts has a critical commitment in deciding the level and fluctuation of output yield.

The general outcome of the stochastic frontier production function gauges is introduced in Table 4.

The production flexibilities of crops cultivated are positive and critical true to form. As per the discoveries, plainly the expanding capital venture at 1%, the produce can be surplus. Opportune accessibility of agricultural contributions inside a sensible cost is a significant aspect for further developing yield in the study area.

Positive and notable flexibility for capital in the event of the extraordinary crops in the chosen area demonstrate the possibility to expand produce by expanding input use. The work versatility for crops is true to form and infers that 1% increment in consumption on employed labor will expand production yield.

The assessed coefficients of the logical factors in the model for technical inefficiency impacts are of interest and have significant implications as displayed in Table 4. The examination demonstrates that the variable of size of farm for crops is positive just as negative yet not significant. It was found that farmers who work on little landholding are actually more proficient, while others can turn out to be more productive by expanding size of activity. Age of the family head is incorporated as an intermediary for cultivating experience to have the impacts of involvement on technical inefficiency. The effect of age on effectiveness is negative at 1%, indicating that more seasoned farmers are more productive.

The use of agricultural machinery also shows a negative as well as significant effect on technical efficiency model which indicates that for different crops different levels of efficiency are present with which efficiency can be increased with usage of better technological innovations to reduce loss of time and effort.

Table 4. Determinants of Productivity and Technical Efficiency of Tomato, Potato and Onion

Variables	Tomato		Potato		Onion	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Stochastic frontier model						
Constant	1.74	6.98***	0.74	3.51***	1.4	3.59***
Hired Labor	0.42	3.11***	0.56	6.11***	0.15	1.16
Fertilizer	0.12	2.11***	0.32	3.73***	0.37	3.70***
Agrochemical	0.39	2.88	0.25	2.89	0.24	2.45
Purchased Seeds	0.82	4.59***	0.89	2.96**	0.89	2.96***
Machinery Cost	0.65	3.47	0.95	4.85***	0.74	3.86
Transportation Cost	0.69	3.56**	0.36	2.47	0.56	3.11
Others Costs	0.33	2.49***	0.44	8.06***	0.53	4.81***
Technical inefficiency model						
Constant	0.04	0.12	-0.18	-1.4	0.1	1.91
Farm size	-0.11	-0.68	-0.14	-6.58***	0	0.32
Age	-0.01	-0.01	0.02	1.69	-0.02	-1.59
Level of education	-0.01	-2.50**	-0.01	-1.14	0	0.08
Farming Experience	-0.06	-0.13	0.01	2.29**	0.69	0.02
Use of Agri Machin	-0.09	-1.99*	-0.22	-2.88***	-0.04	-2.09**
Agricultural Credits	-0.04	-0.38	-0.13***	-1.84	-0.02	-0.93**
Extension Services	0.08	0.97***	0.15	2.24**	0.01	0.44
Variance parameters						
Sigma-square (σ^2)	0.006	3.26***	0.003	4.09***	0.01	5.20***
Gamma (γ)	0.26	11.93***	0.47	4.85***	0.75	2.09***
Ln Likelihood	99.7		144.2		83.5	

Note: *** depicts significant at 1%, ** depicts significant at 5% and * depicts significant at 10%
Source: Field Survey 2022-2023.

The results for agricultural credits are also highly significant for the efficient model which depicts that agricultural credits or loans can increase the productivity significantly in regards with farmer's coverage in case of loss or regarding purchase of other farm inputs.

For the role played by agriculture and extension service departments, we can clearly see from Table 4 that the results are positive and significant, which implies that these departments have a significant impact over the efficiency production followed by significant increase through awareness and trainings. The services provided by these departments help farmers to overcome natural disasters as well as improvement in the agricultural sector.

Frequency distribution of technical efficiency estimates

Findings about farm explicit specialized efficiencies are significant as they indicate comprehensive data on the idea of innovations utilized on farms. The assessments of the recurrence conveyance of Potato, Tomato and Onion TE are given in Table 5.

Assessed effectiveness score for Tomato demonstrates that farms are normally delivering at 78.64% of their latent capacity going from 58.61% to 94.22%, at the given current situation of innovation and input levels. This infers that the vast majority of the farms in the study area confront extreme technical inefficiency issues. It shows that the farmers in general acknowledge around 79% of their specialized capacities. Subsequently, 21% of the specialized possibilities are not understood for Tomato crops. While, in Potato crop the mean productivity score is

73.71% within the range of 50.31% to 90.01%. It demonstrates that general specialized proficiency is 26.29% than the optimal, which can be improved through the better use of available sources [20].

On the other hand, farmers cultivating Onion crops have a mean efficiency of 68.91% even lower than tomato and potato ranging between 48.63% to 88.05%. This deficiency can be improved for about 31%, by the ideal usage of available inputs and improvements through maximizing the usage of inputs and technology.

Table 5. Distribution of Tomato, Potato and Onion farms for different levels of TE

Efficiency rating	**TE of Tomato**		**TE of Potato**		**TE of Onion**	
	N	%	N	%	N	%
< 60	4	4	13	14	15	16
61-70	40	42	40	42	50	52
71-80	36	38	34	36	27	28
81-90	15	15	9	9	4	4
91-100	1	1	0	0	0	0
Mean Efficiency	78.64		73.71		68.91	
Minimum	58.61		50.31		46.23	
Maximum	94.22		89.01		88.05	

Source: Field Survey 2022-2023.

CONCLUSIONS

The important factors for the production were identified as capital inputs such as fertilizer, agrochemical and seeds, labor, machinery cost, transportation cost and other costs. The result shows that these aspects have a significant effect on crop production.

Nevertheless, the use of proper amounts of fertilizer, agrochemicals, seeds, labor and machinery could increase tomato, potato and onion production. Other logical variables in the technical efficiency model indulged size of farm, age, literacy rate, farming experience, agricultural credits or loans and role of extension services. The outcomes from the efficiency analysis showed that the mean technical efficiency was about 79% for tomato and 74% for potato and 69% for onion and therefore on average a farmer in the region cultivates tomato, potato and onion, 21%, 26% and 31% respectively, below the actual potential output that can be achieved through appropriate methods. This depicts that there is substantial capacity to maximize the output and the yield by expanding efficiency of less efficient farms and assisting the efficiency of farms that are intervening near to the frontier level of efficiency.

The effect of higher age indicated that older farmers are more efficient due to indigenous knowledge and experience. This likewise features the fortifying of expansion agriculture and extension service departments on the advanced lines that will work on farmer's capacities to deal with data about present day farming innovations. The determinants also entail that usage of modern machinery could reduce the inefficiency at a significant level. The agricultural credits are necessary to bear the expenses in case of loss to help farmers be motivated to cultivate in subsequent seasons, by allowing them to have credit for inputs after bearing losses in one season. The role of extension services has the most significant impact over reducing technical inefficiency because any insufficiency whether awareness, adaptability to new, difficulty at current can be accessed and resolved through provision of extension services.

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