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Original Article

Analysis of Factors Affecting the Efficiency of Smallholder Wheat Production in Lemo District, Hadiya Zone, SNNPR, Ethiopia

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Abstract

Ethiopian agriculture is known for low productivity. Productivity could be enhanced by perfecting the state of technology or enhancing the efficiency of producers and helping to ensure food security within the currently available technology. The study aimed to measure the level of efficiency of wheat production and to identify factors affecting efficiency in the study area. A multistage and purposive sampling technique was employed to select 366 wheat-growing smallholder farmers. Descriptive and inferential statistics, Tobit, and stochastic production functions were employed. The study was conducted using cross-sectional data collected in the 2021 production season selected at the Lemo district of the Hadiya zone. The stochastic production frontier model is used to estimate efficiency levels, whereas the Tobit model is used to identify factors affecting efficiency. The results it shows there was a significant level of inefficiency in Wheat production. The study result shows that 79.8%, 67.6%, and 53.4% are the mean levels of technical, allocative, and economic efficiency scores, respectively. The estimated stochastic production frontier model indicates that land, oxen, amounts of NPS and urea fertilizers, and amounts of seed are significant determinants of production level. The Tobit model results indicate that the education level of the household, participating in off-farm and non-farm activities, and livestock holdings have a significant positive impact on allocative and economic efficiencies. However, frequency of extension contacts, credit access, and row planting have a positive and significant effect on allocative efficiency. Education level of the households and livestock ownership have a positive and significant effect on cost efficiency. But the plot fertility affects technical efficiency positively and significantly. An increase in family size is statistically significantly and negatively affecting allocative efficiency. Therefore, policies and strategies of the government should be gathered towards the above-mentioned factors.

Keywords

Efficiency, Ethiopian, Lemo district, stochastic frontier, Wheat production.

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1. Introduction

Agriculture has always been a crucial sector in Ethiopia. However, its performance has been adversely affected by the poor use of credit access, amounts of fertilizer used, quality of seed varieties, low capacity and capability of farmers to use modern inputs along with the recommended rate, low extension training services about efficient resource allocation which needed to improve efficiency and productivity (Hunde and Abera, 2019). Efficiency is most important for increasing overall food security and poverty reduction, particularly in major food-producing potential areas of the country (Tesema *et al*., 2019). However, the productivity of the farmers has been low because of inefficient production and efficiency differences among smallholder Wheat producers (Degefa and Jaleta, 2017). Increase in smallholder Wheat productivity to attain global food security because the higher agricultural yield reduces pressure on land in terms of both technical efficiency and allocative efficiency. It is important to develop the agriculture sector and overall economic growth (Zamanian *et al*., 2013). The efficient production of smallholder Wheat production contributes in terms of enhancing farm income but also makes the world competitive within the export market.

If the existing production system is not efficient, the introduction of new technology could not bring the expected improvements in the productivity of wheat and other crops. This implies the need for the integration of modern technologies with improved level of efficiency. Given the existing technology, improvements in the level of efficiency will enable farmers to produce the maximum possible output from a given level of inputs (Wana and Sori, 2020). Hence, improvement in the level of efficiency will increase smallholder Wheat productivity.

The low productivity of the agricultural sector in general and wheat in particular was not in a position to meet the high demand for it. Hence, increasing the country's cereal crop production and productivity in line with rapid population growth to meet their basic subsistence through increasing farming efficiency is highly demanded (Getachew *et al*., 2018). A cereal crop is a significant contributor to the Ethiopian economy, increasing the productivity and efficiency of these products could be taken as a major step in attaining food security (Musa *et al*., 2015). The productivity of wheat can be improved if the factors that affect the efficiency of farmers are identified (Degefa and Jaleta, 2017). However, the efficiency of farmers is determined by several natural, social, and economic factors are another responsible factor for wheat as well as for other crop productivity (Farrell, 1957). Efficiency studies have been carried out in many developing countries. However, few studies have looked at the efficiency of wheat which is a staple food for many developing countries, especially in Africa (Al-feel and Al-basheer, 2012).

Generally, in the case of Ethiopia and some African countries, there is a limited number of studies on the efficiency of smallholder wheat production (Asfaw *et al*., 2019; Al-feel and Al-Basheer, 2012; Mburu *et al*., 2014) which focused on technical efficiency. Much of the existing literature on efficiency in wheat has exclusively focused on the technical efficiency of farmers and overlooked the allocative and economic efficiency of farmers. According to the studies mentioned above, different factors can affect the efficiency level of farmers, but these factors are not equally important and similar in all places at all times. To the best of the author's knowledge, there were no similar studies undertaken on the analysis of factors affecting the efficiency of smallholder wheat production in Lemo District, Hadiya zone. It is crucial to extend their volume of production and efficiency to a minimum to secure their food needs. Improving the efficiency of smallholder Wheat farmers at given input is less costly than adopting and increasing improved technologies in Ethiopia and the study area. However, a smallholder, a farmer who produces only to survive their hand-to-mouth livelihood, owned its production.

Low production and productivity are the characteristics of several wheat farmers in the country in general and particularly in the study area. In the study area, the average productivity of wheat is below the regional and national average productivity. In addition, the production was produced by smallholder farmers used us to survive mostly their livelihood and it does not meet their demand. Therefore, the study focuses on estimating the level of efficiency and identifies factors affecting the efficiency of wheat production.

2. Concepts of efficiency and productivity in production

In microeconomics theory, the objective of the producer is to identify the way of producing maximum output using a given input with minimum cost of production. In this theory take as read producers within the framework of the free-market rule and then, allocate input and output efficiently to obtain the objective of maximum profit with minimum cost (Acar et al., 2017). Microeconomic theory is based on the assumption of optimizing behavior, either from a producer or a consumer approach, and assumes that producers optimize both from a technical and economic perspective: From a technical perspective, producers optimize by not wasting productive resources, and from an economic perspective producers optimize by solving allocation problem involving prices.

According to Geta et al., (2013), an understanding of the relationships between productivity and efficiency would provide policymakers with information to design programs that can contribute to increasing production potential among smallholder farmers. Productivity and efficiency are two interrelated terms and are not precisely the same (Coelli et al., 2005). According to Fried (2008), productivity is a ratio of production output to inputs; Productivity is the total output per one unit of total input. The efficiency of a production unit is defined as the ratio between the output(s) produced by the unit and therefore the number of resources utilized in the assembly process (Veiderpass and Andersson, 2007), Productivity improvements can be achieved in two ways. One can either improve the state of the technology by inventing new plows, pesticides, and rotation plans. Increasing agricultural productivity also has numerous advantages. First, facilitates the flow of resources from one sector to another and contributes to economic growth. Second, higher agricultural productivity like wheat productivity results in lower food prices for consumers and a rise in the income of producers increases the welfare of the society thereby enhancing the economic growth of the country. Third, agricultural productivity growth also improves the competitive position of the sector (Haji, 2008). The factors that may affect the technical efficiency of wheat production include: livestock ownership, age of household head, sex of household head extension contract, access credit, training, family size, non-farm activity, education level, distance to farm, etc. These could be the cause of inefficiencies in the production process of smallholder farmers. These factors are (1) Environmental and policy factors (2) demographic characteristics (3) socioeconomic characteristics (4) institutional factors.

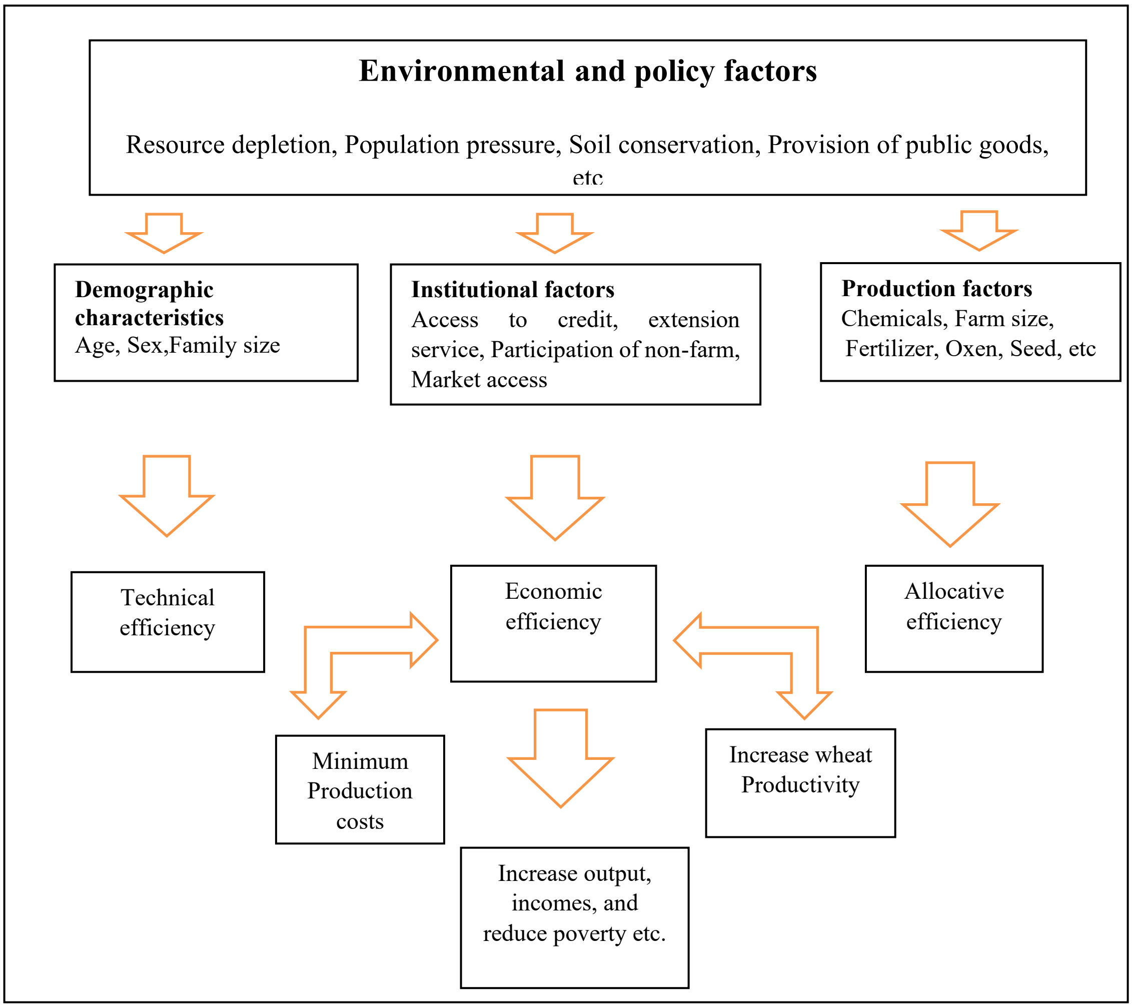

Fig-1: Source: Conceptual framework of efficiency; Adapted from (Sibiko, 2012)

3. Research Methodology

A. Description of the Study Area

This study was carried out in the Lemo district, which is found in the Hadiya Zone, Southern Nation Nationalities and People's Regional State (SNNPRS), Ethiopia. According to CSA (2007), the total population of Lemo district is 118,594 composed of 58,666 males and 59,928 females. Regarding the place of settlement, 1.73% of the population lives in semi-urban and therefore the rest in the country. Subsistence mixed agriculture (crop and livestock) is the major livelihood basis of rural settlers. The study area has undertaken a high extent of wheat production. However, the use of agrochemicals, irrigation, and manure for soil fertility practices and wheat production is low.

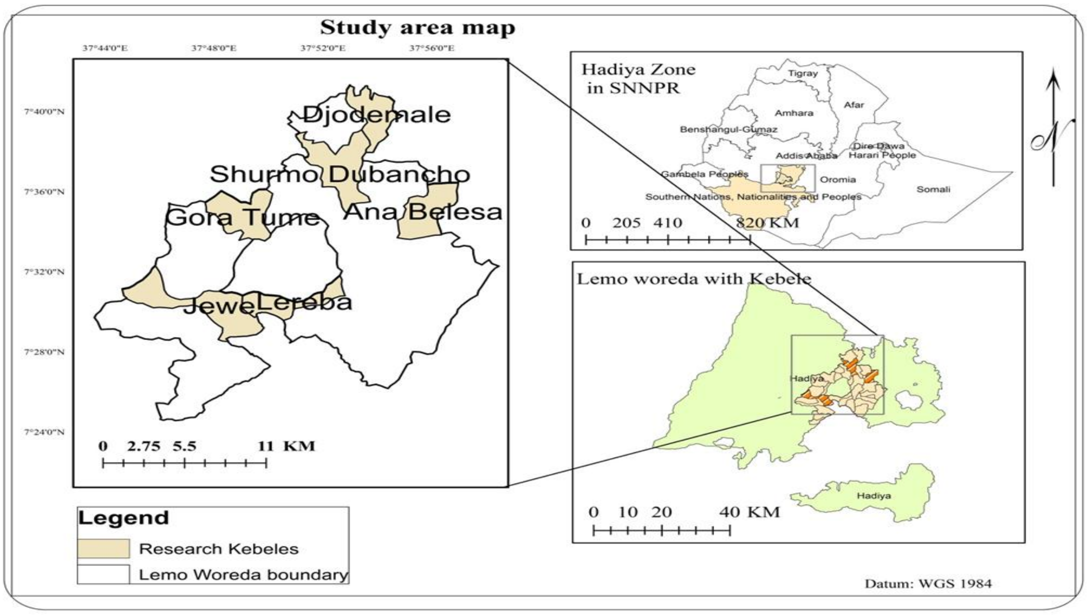

Fig-2: Study Area

B. Sampling Technique and Sample Size

Lemo District was purposively selected for its high concentration of wheat-producing households and significant production levels. From its 33 rural Peasant Associations (PAs), 14 were identified as having high wheat production potential based on district agricultural service records; six PAs were then randomly selected from these 14 using simple random sampling (Table 1). Using a list of 4,375 wheat-producing smallholder households across these six PAs during the 2021 cropping season (maintained by agricultural extension services), a total sample size of 366 households was determined using Yamane's (1967) formula for a finite population at a 5% margin of error $n = \frac{N}{1+N(e)2}$ Where n is the sample size, N = the total number of households in the selected Peasant associations (4375), and e = acceptable error margin (0.05). This sample was proportionally allocated to each selected PA based on the number of wheat-producing households.

Table 1: Total sampled households and sample size selection from each peasant association

No	Name of Peasant Association	Total Wheat Growing households	Sample size selected
1	Ana belesa	430	36
2	Shurmo Dubancho	922	77
3	Jawe	1116	94
4	Dijo damale	729	61
5	Lareba’a	458	38
6	Gora Tume	720	60
Total	4375		

Source: Lemo District agricultural and natural office (2022)

C. Types of data, Source of Data, and method of data collection

Both qualitative and quantitative data were collected from smallholder farmers who produce wheat in the production season. The study used both primary data and secondary data to attain stated objectives. Primary data was collected through personal interviews by using data collection instruments and questionnaires with structured interview schedules. The secondary data were collected from different sources including NGOs, agricultural offices, and CSA.

D. Specification of Econometric Model

The foundational work of Farrell (1957) has inspired a wide range of methodologies for assessing productivity and efficiency (Abdul-Salam and Phimister, 2016). Among these, the Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA) are the most frequently applied techniques. As noted by Asmara and Begashaw (2018), both methods often yield highly correlated outcomes. Building on the stochastic frontier framework introduced by Aigner et al. (1977) and further developed by Schmidt and Sickles (1984) and Almanidis and Sickles (2011), this study employs the SFA approach to estimate technical efficiency among wheat farmers. Specifically, the analysis utilizes a Cobb-Douglas production function to model the production process.

Ln(Qt)= $\beta_0 + \beta_1 \ln(\text{NPS}) + \beta_2\ln(\text{Urea}) + \beta_3\ln(\text{chemicals}) + \beta_4\ln(\text{seed}) + \beta_5\ln(\text{labour}) + \beta_6\ln(\text{land}) + \beta_7\ln(\text{oxen}) + v_i - u_i$

The cost frontier model was formulated as:

Ln(Cost)= $\alpha + \alpha_1 \ln(\text{NPS}) + \alpha_2\ln(\text{Urea}) + \alpha_3\ln(\text{chemicals}) + \alpha_4\ln(\text{seed}) + \alpha_5\ln(\text{labor}) + \alpha_6\ln(\text{land}) + \alpha_7\ln(\text{oxen}) + v_i - u_i$

The reduced farm of the Tobit Regression Model can be written as:

ES= $\delta_0 + \delta_1 x_1 + \delta_2 x_2 + \delta_3 x_3 + \delta_4 x_4 + \delta_5 x_5 + \delta_6 x_6 + \delta_7 x_7 + \delta_8 x_8 + \delta_9 x_9 + \delta_{10} x_{10} + \delta_{11} x_{11} + \delta_{12} x_{12} + \delta_{13} x_{13} + \delta_{14} x_{14} + \delta_{15} x_{15} + \delta_{16} x_{16}$ +Ui

Where ES the latent variable representing efficiency is the score of technical, allocative, and economic efficiencies; $\delta_i$are the vector parameters to be estimated; X_i Represent various farm-specific variables; U**i** is the error term.

4. Result And Discussion

This chapter is further divided into two sub-sections; descriptive statistics and econometric results; The study along with previous research findings was briefly discussed.

A. Demographic and Socio-economic Characteristics of Sampled Households

The socio-economic characteristics of the sampled farmers indicate that the average age of household heads is 44.66 years, placing them within the most economically active age group. This suggests a favorable capacity for labor-intensive agricultural activities, likely supported by their average of 21.33 years of farming experience. Education levels, however, are relatively low, with farmers averaging 1.97 years of formal schooling. Despite this, education remains a key factor in enhancing managerial skills and technology adoption, both of which are crucial for improving farm efficiency and productivity.

The average household size is 6.39 members, which is notably higher than the district average, indicating a greater potential for family labor contribution. Livestock ownership, an important aspect of mixed farming systems, averages 3.15 tropical livestock units per household, with considerable variation across farms. This diversity in livestock holding highlights differences in farm resources, which may influence household income levels and access to farm inputs such as draft power. Overall, these characteristics provide valuable context for understanding the efficiency and production potential of wheat farmers in the study area.

Table 2: Descriptive Analysis for Continuous Variables

Variable	Mean	Std. Dev.	Min	Max
AGHH	44.66	9.142	25	72
FARMEXP	21.33	6.541	10	45
EDUCL	1.97	.856	0	12
FAMSIZE	6.39	1.794	2	14
EXTCONT	1.36	1.088	0	3
LIVSTOCK	3.15	1.129	1	7.02
DISMKT	3.54	1.298	.5	7
PLOTPRO	2.45	1.518	.5	6
FRAG	2.11	1.160	1	6

Source: Own computation (2022)

B. Characteristics of Respondents

Concerning the gender of smallholder farmers, 33.06% of the households were female-headed, while the majority, 66.94%, were male-headed (Table 3). Female-headed households often face greater challenges in agricultural production due to limited access to resources, labor, and support services compared to their male counterparts.

Regarding livelihood diversification, 46.99% of the sampled farmers reported participation in off-farm or non-farm activities such as petty trading, carpentry, firewood selling, and handicrafts, while 53.01% were not involved in such activities. The adoption of row planting, which promotes efficient seed use and facilitates the application of agronomic best practices to improve wheat yields, was reported by 44.81% of households. The remaining 55.19% practiced traditional broadcast planting methods. Extension services play a crucial role in disseminating new and improved agricultural practices, thereby enhancing farm productivity. On average, sampled household heads received 3.43 extension visits during the production year, with a minimum of 2 and a maximum of 6 visits. The average travel time from the village to nearby towns—where essential services such as farm cooperatives, credit institutions, agricultural training centers, health facilities, markets, and secondary schools are located—was approximately 14 minutes. Although some transportation services are available, respondents reported challenges due to poor road infrastructure and the long distance from their residences to the nearest transport access points. As a result, farmers and their families often spend considerable time accessing these services.

Table 3: Descriptive Statistics for Dummy Explanatory Variables

Variables	Types	Frequency	%
Gender	Male	245	66.94
	Female	121	33.06
Access to credit	Users	213	58.20
	Non-user	153	41.80
Environmental factors	Affected	140	38.25
	Not affected	226	61.75
Offarm/non-farm activity	Participant	172	46.99
	Non-participant	194	53.01
Row planting system	Yes	164	44.81
	No	202	55.19
Fertility of plot	Yes	206	56.28
	No	160	43.72

Source: Own computation (2022)

In line with findings by Musa, who reported a positive and significant relationship between credit access and farm efficiency, this study also underscores the importance of financial access. However, 41.8% of the 366 sampled households reported having no access to credit, which could limit their ability to invest in productivity-enhancing inputs and technologies.

C. Econometric Result Analysis

(a) Tests of hypotheses

Before discussing parameter estimates of the production frontier function and the inefficiency effects, it is advisable to run several hypothesis tests to choose an appropriate model for further analysis and interpretation.

Table 4: Generalized Likelihood-Ratio Test of Hypotheses for Parameters Of SPF

Null hypothesis	Value of log-likelihood functions	λ	Critical value	Decision
H_0: $\gamma = 0$	-103.91	19.94	2.71	Reject H_0
H_0: $U_i = \delta_0 = \delta_1 = \ldots = \delta_{12} = 0$	-93.94	40.30	18.31	Reject H_0
H_0: $\sum\beta_I = 1$	-41.06	67.46	3.84	Reject H_0

Source: Own computation (2022)

The study tests two key hypotheses related to the efficiency of wheat production, H_0: $\gamma = 0$, where the parameter, $\gamma = \sigma^2/(\sigma^2 + \sigma_v^2)$, is such that there is no inefficiency in the production of wheat. A rejection of this hypothesis indicates the presence of inefficiency among wheat producers.

The second hypothesis assesses whether the explanatory variables in the technical inefficiency effects model are jointly insignificant. This is tested by comparing the log-likelihood values of a restricted stochastic frontier model (without inefficiency variables) and a full model (with inefficiency variables). The test statistic λ=40.30\lambda = 40.30 exceeds the critical value of 18.31 at the 1% significance level, leading to the rejection of the null hypothesis. This confirms that the inefficiency effects are significantly influenced by the explanatory variables.

Additionally, the production technology was evaluated under constant and variable returns to scale. The log-likelihood values for these models were –41.06 and –73.79, respectively. The likelihood ratio test yielded a value of 67.46, far exceeding the critical value of 3.81. Thus, the hypothesis of constant returns to scale is strongly rejected, indicating that the wheat production system exhibits variable returns to scale.

(b) Parameter estimates of the SFM

The results of the model showed that, except for chemical and labor, the remaining input variables in the production function, Land, NPS, Urea, Oxen-power, and seed, had a positive and significant effect on the level of wheat output. The MLE values of the coefficients are interpreted as the elasticity of production. Hence, the elasticity of output to land (0.72) suggested that wheat production was relatively sensitive to land. As a result, a 1 percent increase in several lands (ha) resulted in a 0.72% increase in wheat production, keeping other factors constant. The result is consistent with the findings of (Wudineh and Endrias, 2016).

Table 5: Maximum Estimates for SFM With Cobb-Douglas Production Function

Variables	Coef.	Std. Err	P>z
Lnland	.721**	.068	0.000
Lnlabor	.010	.021	0.626
Lnoxen	.076**	.033	0.021
Lnseed	.032**	.053	0.030
Lnchemical	.019	.013	0.139
Lnurea	.054**	.025	0.028
LnNPS	.096**	.036	0.008
_cons	2.630**	.339	0.000
sigma_v	.053		Log likelihood = 112.2186
sigma_u	.312		Number of obs = 366
sigma2	.101		Prob > chi2 = 0.0000
lambda	5.884		

*Note: ** refers to a 5% significance level. Source: Own computation (2022)*

The results presented in Table 5 indicate that the estimated coefficients from the stochastic frontier model align with the expected economic theory. Key inputs such as land and NPS fertilizer were found to have a positive and statistically significant impact on wheat production at the 1% level, while oxen, seed, and urea were also positive and significant at the 5% level. These findings suggest that increased use of these inputs leads to a significant rise in wheat output. In contrast, labor showed a positive but statistically insignificant effect on wheat production.

Using a Cobb-Douglas production function framework, the coefficients can be interpreted as partial elasticities of output concerning each input. Specifically, a 1% increase in land use, oxen, seed, urea, and NPS leads to output increases of 0.72%, 0.076%, 0.32%, 0.054%, and 0.096%, respectively, holding other inputs constant. Among these, land had the largest effect, highlighting it as the most influential input in wheat production in the study area.

The results further imply increasing returns to scale—indicating that a simultaneous 1% increase in all inputs would result in more than a 1% increase in output. This suggests the potential for greater productivity if input use is scaled up proportionally. However, the relatively low elasticity values also reflect the inelastic responsiveness of output to input changes, possibly due to constraints such as limited access to resources, suboptimal input use, and natural conditions during the 2021 production season. These findings are consistent with previous research by Getachew et al. (2018) and Tesema et al. (2019).

Table 6: Estimates of the Cobb-Douglas frontier cost function

Variables	Coef.	Std. Err.	P>z
Lncland	.717	.126	0.000
Lnclabor	.098	.057	0.085
Lncoxen	.408	.091	0.000
Lncseed	.184	.097	0.008
Lncchemical	.054	.039	0.167
Lncurea	.071	.062	0.253
LncNPS	.086	.098	0.007
_cons	1.926	.599	0.001
sigma_v	.245	.0245	
sigma_u	.516	.044	
sigma2	.326	.038	
Lambda	2.102	.063	

Source: Own computation (2022)

The results from the cost frontier analysis (Table 6) show that most input cost variables have the expected positive signs, indicating their contribution to total production costs. The costs of land, oxen, seed, urea, and NPS were statistically significant at the 1% level, confirming their strong influence on total production costs. Additionally, the coefficient for output adjusted for statistical noise was also significant at the 1% level.

In contrast, the costs of labor and chemicals were found to be statistically insignificant. Although labor had a positive coefficient, its insignificance suggests that wheat output is not directly influenced by labor input. Instead, labor use is likely determined by external factors such as soil type, weed infestation, and other field conditions. This is consistent with findings by Geta et al. (2013).

Furthermore, the cost of chemicals was also insignificant, largely due to the low usage rate in the study area—more than half of the farmers did not use chemicals during the production season. This highlights the limited role of chemical inputs in the current wheat production practices.

(c) Efficiency Score and their Distribution

The efficiency analysis presented in Table 7 reveals significant variation in technical efficiency (TE), allocative efficiency (AE), and economic efficiency (EE) among wheat-producing farmers. Technical efficiency scores ranged from 0.246 to 0.981, with an average of 0.798. This indicates that the average farmer could increase output by approximately 20.2% using existing inputs more efficiently, or conversely, reduce input use by the same proportion to maintain current output levels.

Allocative efficiency ranged from 0.165 to 0.914, with a mean of 0.676. This suggests that farmers, on average, could reduce their input costs by 33.4% by using the optimal combination of inputs, given their prices. The average cost-saving potential for a farmer with this level of AE, compared to the most allocative efficient farmer, is approximately 35.44%.

Economic efficiency, calculated as the product of TE and AE, had a mean score of 0.534, with values ranging from 0.096 to 0.841. This implies that the average farmer could reduce production costs by 53.4% to achieve full economic efficiency. Moreover, the average farmer could save up to 55.41% of production costs if they reached the efficiency level of the most economically efficient farmer.

Overall, these findings highlight considerable inefficiencies in wheat production in the study area but also suggest a strong potential for improvement through better resource allocation and more efficient input use. These results align with the findings of Wana & Sori (2020).

Table 7: Summary Statistics of Technical, Allocative, And Economic Efficiency Scores of Sample Households

Types of Efficiency	Mean	Std. Dev.	Min	Max
TE	0.798	0.131	0.246	0.981

AE	0.676	0.143	0.165	0.914
EE	0.534	1.123	0.096	0.814

Source: Own computation (2022)

The mean levels of efficiencies were comparable to those from other similar studies in Ethiopia. Accordingly, (Mekonen E. G., 2015)found mean TE, AE, and EE of 67.1, 67.25, and 45.14% respectively for wheat producers in respectively for sesame producers in the Selamago district, southern Ethiopia.

(d) Determinants of efficiency differentials among farmers

Following the measurement of technical, allocative, and economic efficiencies among wheat farmers, the study aimed to identify the key factors responsible for efficiency differences. To achieve this, a Tobit regression model was applied using the calculated efficiency scores (TE, AE, and EE) as dependent variables.

The results, presented in Table 8, show that education level, family size, and plot fertility significantly and positively influence efficiency at the 1% significance level. Additionally, livestock holdings, credit access, frequency of extension contact, off/non-farm income, and the practice of row planting were significant at the 5% level. These positive relationships suggest that improvements in these variables are associated with higher efficiency levels among farmers.

Conversely, variables with negative coefficients were found to negatively affect efficiency, indicating that increases in these factors could reduce farmers' performance. However, several variables—including age, gender, farming experience.

Table 8: Factors Affecting the Efficiency of Wheat-Producing Farmers

VAR	TE		AE		EE	
	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
Ahh	.0417	.028	.012	.149	-.011	.139
Ghh*	.667	.662	-.001	.616	.016	.008
Edn	-.009	.001	.002 *	.001	.006*	.001
Fexp	.245	.381	-.004	.620	.001	.007
Plotpro	-.294	.411	-.001	.950	.001	.013
Rowp*	.287	.002	.022*	.0073	.002	.006
Fsize	1.038	.150	.273	.047	-.082**	.013
Extcont	-.622	.056	.264**	-.124	.008	.003
Nplow	.611	.681	-.014	.332	-.001	.005
Offarm*	0.0516**	0.0260	.020**	.002	.004**	.004
credit*	2.54	.542	.041**	.023	.004	.056
Frag	-.450	.715	-.003	.559	.007	.013
Fertplot*	.097**	.002	.01	.093	-.012	.014
Ahh	.0417	.028	0.0185***	0.0063	0.0067**	0.0028
Ghh*	.667	.662	.01	.508	-.009	.012
Edn	-.009	.001	.016	.264	.007	.013
Fexp						

*Note: *, **, and *** refer to 1%, 5%, and 10% significance levels, respectively. And dy/dx is a discrete change of the dummy variable from 0 to 1.*
Source; author's computation (2022)

5. Conclusion

This study examined the factors influencing the efficiency of smallholder wheat production in Lemo District using data from 366 farmers during the 2021 production year. A stochastic frontier model with inefficiency effects was employed to measure technical (TE), allocative (AE), and economic efficiency (EE) at the plot level. A Tobit regression model was used to identify socio-economic factors affecting these efficiencies.

The analysis revealed significant inefficiencies in wheat production, with average TE at 79.8%, AE at 67.6%, and EE at 53.4%. These results indicate that farmers could increase output by approximately 20.2% through better use of existing inputs and technology. Additionally, average farmers could reduce input costs by 33.4% through optimal input combinations, and total production costs by up to 46.6% if full economic efficiency were achieved. The study also found that inputs like land, seed, oxen-power, NPS, and urea significantly and positively impacted wheat output, while labor and chemical inputs were insignificant.

Efficiency levels varied widely among plots, suggesting a strong potential for improvement. The Tobit regression identified education level, family size, plot fertility, livestock holding, access to credit, extension contact frequency, off/non-farm income, and row planting as significant determinants of efficiency. These findings imply that targeted development policies and support programs focused on these factors could substantially enhance wheat production efficiency in the area. Based on these results, the study recommends that policy interventions address key socio-economic and agronomic variables to close efficiency gaps and improve productivity in smallholder wheat farming.

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