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Technical Efficiency Analysis of Garlic Farming: a Case Study West Nusa Tenggara Province

Hernawati[1]*, Elita Maydasari[1], Riki Sahman[1]

[1] Agrotechnology Study Program, Faculty of Agriculture, Nahdlatul Wathan University Mataram, Mataram, Indonesia.

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Corresponding Author:
Hernawati
hernawati2480@gmail.com

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Abstract: The demand for garlic is increasing along with population growth The increase in garlic consumption over time if not balanced with an increase in domestic production will lead to increasing dependence on imports. The purpose of this paper is to analyze: Analyze production factors that influence productivity; Estimate the level of technical efficiency; and Analyze socio-economic factors that influence technical inefficiency in garlic farming. The sample was 40 samples. The sample was determined intentionally (purposive). Estimation of technical efficiency used Stochastic Frontier (SFA) with the Cobb-Douglas production function model. The results of the study indicate that factors that influence increasing garlic production are land area, urea fertilizer, ZA fertilizer, NPK fertilizer, and family labor. Input factors that have a significant influence as risk inducing factors are ZA fertilizer, insecticides, herbicides, and labor within and outside the family. Input factors that have a significant influence in reducing technical inefficiency are NPK fertilizer. There are no input factors that significantly increase technical inefficiency; Technical efficiency reaches an average of 0.87 which indicates that there is still a 13% opportunity for farmers to increase production to their frontier using existing technology; and Socio-Economic Factors that influence technical inefficiency are influenced by experience.

Keywords: Case study; Garlic production factors; Technical efficiency

Introduction

Indonesia is one of the world's largest garlic importers. This is due to high public consumption not being supported by national garlic production. Garlic production has fluctuated over the past three years, reaching 45,092 tons in 2021, a significant decline in 2022 to 30,582 tons, and an increase of 39,254 tons in 2023 (BPS, 2025). Meanwhile, the total national garlic demand is 667,000 tons, with 84.04% for household consumption, 8.40% for hotels, restaurants, and catering (HOREKA) and street vendors (PKL), 3.36% for seed supplies, and 4.20% for industry (Directorate General of Horticulture, 2023). China is the world's largest garlic exporter, with an average planted area of 810,000 hectares.

The average garlic productivity in Indonesia is only 8.2 tons/ha, still below the highest potential productivity of 9-12 tons/ha. This figure is significantly lower than the average garlic productivity in China, which reaches 25.89 tons/ha. Low garlic production in Indonesia is due to limited planting areas and low productivity. In 2023, the highest garlic production occurred in September, reaching 7.57 thousand tons with a harvested area of 0.88 thousand hectares.

The provinces with the largest garlic production are Central Java, West Nusa Tenggara, and East Java. Central Java contributed 74% to national production, with production reaching 29.05 thousand tons and a harvested area of 3.92 thousand hectares. West Nusa Tenggara contributed 17.98%, with production reaching 7.06 thousand tons and a harvested area of 0.71 thousand hectares. East Java contributed 2.68%, with production reaching 1.05 thousand tons and a harvested area of 0.27 thousand hectares. In addition to limited land area, efforts to develop national garlic production are also hampered by relatively high farming costs due to expensive input prices (Zulkif et al., 2018). Horticultural commodity farming in Indonesia is generally dominated

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by farmers with small plots of land and limited capital, necessitating effective fertilizer subsidy policies to increase farm productivity and profitability (Rachman, 2003).

Increased production and productivity can be enhanced by government initiatives to optimize input use and adopt technology, although this is relatively difficult to achieve in the short term (Apriani et al., 2018). Furthermore, productivity can be increased by (1) increasing input use; (2) implementing new technology; and (3) managing available resources more efficiently. The area of land cultivated by farmers is a key factor in determining production volume, not differences in better management of production factors (Djoka & Kune, 2019; Falo et al., 2016; Hernawati et al., 2023).

Success in managing production factors can be illustrated through an efficiency approach. Achieving technical efficiency is crucial in efforts to increase production and profitability in farming. Technical efficiency describes the potential production that can be achieved at a given input level (Farrel, 1957).

Research on efficiency in food crop farming has been extensively conducted. Production inefficiency is a limitation in agricultural productivity, and the sources of inefficiency are varied. Therefore, the key is to improve the efficiency of production input use by farmers. Understanding the allocation of production input use, risks, efficiency, and socioeconomic characteristics of farmers that influence efficiency can help policymakers in designing agricultural policies and programs that can increase agricultural production (Msuya & Ashimogo, 2005).

Farmers frequently face inefficiency in farming, whether in food crops, horticulture, or plantations. In food crop farming, particularly rice, the average technical efficiency value across research areas varies widely, from 50 percent to 92 percent (Aboaba, 2020; Adeshina et al., 2020; Al-Wasity et al., 2021; Fauzan, 2020; Houngue & Nonvide, 2020; Melati & Mayninda, 2020; Mulyana et al., 2020; Okello et al., 2019; Purba et al., 2020; Soetjipto, 2020; Subedi et al., 2020). The average Technical Efficiency value for corn in various research areas varies from 46 percent to 84 percent (Edison & Rosyani, 2021; Hou et al., 2021). Likewise, the average ET value for soybeans varies from region to region, ranging from 26 percent to 87 percent (Asodina et al., 2021; Bambani et al., 2021). Wheat also varies from region to region, ranging from 61 percent to 95 percent (Miriti et al., 2021; Zhou et al., 2021). In horticultural crops, research on potato farming conducted by Uche et al. (2021), showed an ET value of 63 percent. Peanuts showed an ET value of 73 percent, a study conducted by Anang (2021). Vegetable crops have varying ET values in the study area, ranging from 62 percent to 89 percent (Martinovska Stojcheska et al., 2021; Ogunmola et al., 2021). Pineapple plants have ET values of 34 percent and 93 percent (Lubis et al., 2021).

While there is extensive research on the technical efficiency of food crops, there is little research on horticultural crops, particularly garlic. Therefore, research in this area is crucial for increasing efficiency and reducing the negative environmental impacts of excessive use of production inputs. Furthermore, it can increase profits, reduce costs, and increase output, making it a crucial step toward achieving sustainable farming.

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Method

This study analyzes the technical efficiency of garlic farming on Lombok Island, West Nusa Tenggara Province. The location selection was purposive. This study used primary data. A sample size of 40 was used.

A stochastic frontier production function was used to analyze the factors influencing garlic production and its technical efficiency, as follows:

$$Y_i = \alpha LHN^{\beta 1} BNH^{\beta 2} PUR^{\beta 3} ZA^{\beta 4} NPK^{\beta 5} PSP^{\beta 6} POR^{\beta 7} INS^{\beta 8} FUNG^{\beta 9} HER^{\beta 10} TKD^{\beta 11} TKL^{\beta 12} e^{\varepsilon} \quad (1)$$

Coelli et al. (2005) explains that in the stochastic model the components *error* (ε) consists of two types, namely v_i and u_i, so that:

$$\varepsilon_i = v_i - u_i \quad (2)$$

Components error v_i elated to external factors such as weather, pest and disease attacks, and so on, including input variables not specified in the production function. Meanwhile, the error component u_i relates to internal factors that influence inefficiency.

Furthermore, to facilitate analysis and coefficient estimation, the production function is transformed into a multiple linear form using the natural logarithm (*ln*) transformation as follows:

$$LnY_i = \beta_0 + \beta_1 LnLHN + \beta_2 LnBNH + \beta_3 LnPUR + \beta_4 LnZA + \beta_5 LnNPK + \beta_6 LnPSP + \beta_7 LnPOR + \beta_8 LnINS + \beta_9 LnFUNG + \beta_{10} LnHER + \beta_{11} LnTKD + \beta_{12} LnTKL \quad (v_i - u_i) \quad (3)$$

Where: Y_i (production (ton)); LHN (land area (ha)); BNH (seed (kg)); PUR (urea fertilizer (kg)); ZA (ZA fertilizer (kg)); PSP (SP36 fertilizer (kg); POR (organic fertilizer (kg)); INS (Insecticide (liter)); FUNG (Fungicide (kg); HER (Herbicide (kg); TKD (labor in the family (hok)); TKL (labor outside the family (hok)); β_0 (intercept); β_i

(estimated coefficient); v_i (error variable); u_i (non-negative error variable caused by technical inefficiency).

The results of the production function estimation are then used to measure the technical efficiency of the farm. The method for calculating technical efficiency (Coelli et al., 2005).

$$ET_i = \frac{Y_i}{Y_i^*} = \frac{exp(x_i\beta - u_i)}{exp(x_i\beta)} = exp(-u_i) \quad (4)$$

Where: ET(Technical efficiency ($0 \leq ET \leq 1$)); Y_i (Production actual); Y_i^* (production limits (*frontier*)).

A farming business is categorized as technically efficient if it has a value ET > 0.70 (Coelli et al., 2005)

The technical inefficiency effect refers to a model developed by (Coelli et al., 2005). Technical inefficiency is described by the error component u_i in the production function. The value of technical inefficiency is inversely proportional to the value of technical efficiency. The equation for the technical inefficiency effect model for farming is as follows:

$$TI_i = \delta_0 + \delta_1 UMR + \delta_2 PDK + \delta_3 PGL + \delta_4 JRK + \delta_5 TAG \quad (5)$$

Where: TI_i (technical in-efficiency effect); δ_0 (intercept); AGE (farmer age (years)); EDU (formal education (years)); EXP (farming experience (years)); DST (distance from home to farm (meters)); CSL (frequency of attending extension services (times)); FML (number of family dependents (people)); δ (parameter to be estimated); Wi (random error term which is assumed to be independent and normally truncated distribution with N (0,σ²).

Result and Discussion

Input Factors Affecting Production

The OLS estimation method reflects the average performance of farmers' production processes at the technology level used. The results of the OLS production function estimation are shown in Table 1.

Table 1. Results of the OLS production function estimation for garlic production on Lombok Island in 2025

Variable	Parameter	Coefficient	Standart Error	T Value
Intersep	β_0	1.476[ns]	1.678	0.879
Land area	β_1	0.744[a]	0.223	3.334
Seeds	β_2	-0.036[ns]	0.254	-0.143
Urea	β_3	0.006[ns]	0.019	0.302
ZA	β_4	0.013[a]	0.009	2.971
NPK	β_5	0.122[b]	0.107	2.133
SP36	β_6	-0.001[ns]	0.010	-0.114
Organik fertilizer	β_7	-0.097[ns]	0.012	0.971
Insecticide	β_8	0.169[c]	0.091	1.866
Fungicide	β_9	-0.018[ns]	0.018	-0.999
Herbicide	β_{10}	-0.114[ns]	0.111	-1.033
Family Labor	β_{11}	0.354[c]	0.187	1.889
Outside Family Labor	β_{12}	-0.097[ns]	0.166	-0.584
R^2		0.87		

Notes: significant at level a (α 1%), b (α 5%) c (α 1%) ns: non significant.

Table 1 shows that the average production function is formed quite well (best fit), reflecting farmer behavior in production. The average coefficient of determination for the production function is 0.87, indicating that the inputs used in the model can explain 87% of the variation in garlic production in the area, with 13% being due to external influences beyond farmers' control (such as climate, pest and disease attacks, and modeling errors). Partial testing (t-test) of the production function indicates that the production factors of land area, ZA fertilizer, NPK fertilizer, insecticide, and family labor significantly influence garlic production. The variables influencing garlic production at the 99.9% confidence level are land area and ZA fertilizer; NPK fertilizer has an effect on production at the 95% confidence level. Meanwhile, the variables of insecticide and family labor influence garlic production at the 90% confidence level.

The second stage of the SFA approach is to estimate the stochastic frontier production function using the MLE method. The results are shown in Table 2.

Table 2. Results of Stochastic Frontier Analysis Production Function Estimation with MLE for Garlic Production on Lombok Island in 2025

Variable	Parameter	Coefficient	Standard Error	T Value
Intercept	β_0	1.713[b]	0.991	1.729
Land Area	β_1	0.789[a]	0.137	5.759
Seeds	β_2	-0.087[ns]	0.159	-0.547
Urea Fertilizer	β_3	0.006[a]	0.014	2.436
ZA	β_4	0.009[b]	0.007	2.379
NPK	β_5	0.166[b]	0.078	2.120
SP36	β_6	0.001[ns]	0.008	0.150
Organic fertilizer	β_7	0.014[ns]	0.009	1.523
Insecticide	β_8	0.054[ns]	0.075	0.735
Fungicide	β_9	-0.055[ns]	0.014	-0.832
Herbicide	β_{10}	-0.078[ns]	0.081	-0.959
Family Labor	β_{11}	0.241[b]	0.145	1.873
Outside Family Labor	β_{12}	0.004[ns]	0.125	0.031
Sigma squared (σ^2)		0.376		2.143
Gamma (γ)		0.869		10.032
Log Likelihood function-OLS				113.276
Log Likelihood function-MLE				160.434

Notes: significant at level a (α 1%), b (α 5%) c (α 1%) ns: non significant.

In Table 2, the MLE Log Likelihood value (160.434) is greater than the OLS Log Likelihood value (113.276). This indicates that the production function estimation using the MLE method is better at describing field conditions compared to the OLS method (Coelli et al., 2005). The Sigma Squared coefficient value obtained is 0.376 and is significant at the 95% confidence level, indicating that the inefficiency error term (u_i) is normally distributed. The Gamma (γ) value of 0.869 indicates that 86.9% of the residual variation in the model comes from inefficiencies (u_i) that can be controlled by farmers. The remaining 13.1% is caused by random error in measurement/noise (v_i in the form of production risks that cannot be controlled by farmers, such as weather and pest and disease attacks. This indicates that technical inefficiency plays an important role in explaining the level of garlic production achieved by farmers on Lombok Island. This finding is consistent with the research of Kurniasih et al. (2023) on garlic and on cocoa (Attipoe et al., 2020). The Return to Scale (RTS) analysis indicates that garlic production is in a position of increasing returns to scale because the sum of the coefficients of the production factors is 1.713, or greater than one (β > 1). This means that adding production factors will result in a proportionately greater increase in production output.

Table 2 shows that the coefficients for the variables land area, urea, ZA, SP36, NPK, organic fertilizer, insecticide, family labor, and non-family labor are positive, as expected. The coefficients for the variables seed, fungicide, and herbicide are negative. This is inconsistent with the assumptions of the Cobb-Douglas production function, which only explains regions I and II, with a sign that should be positive. However, this suggests that the use of seeds, fungicides, and herbicides may have exceeded recommendations. Production factors with a positive and significant influence at the 99.9% confidence level are land area and urea fertilizer, while ZA fertilizer, NPK fertilizer, and family labor have a significant influence at the 99% confidence level.

Land area significantly influences garlic production with an elasticity of 0.789, meaning a 1% increase in land area can increase garlic production by 0.789% (all other things being equal) (Adzawla & Alhassan, 2021; Hernawati et al., 2023; Khatri-Chhetri et al., 2023; Kurniasih et al., 2023). The elasticity of land area in the stochastic frontier production function is greater than the elasticity in the average production function (OLS). This indicates that land use in the stochastic frontier production function is more elastic than in the average production function. Land has a relatively high production elasticity, indicating that land expansion is a significant strategy for increasing garlic production.

Urea fertilizer production factors have a significant effect, with an elasticity of 0.006. This means that every 1% increase in urea use can increase production by 0.006% (ceteris paribus). The elasticity of urea fertilizer in the stochastic frontier production function is smaller than the elasticity in the average production function. This indicates that farmers are still rational in increasing urea fertilizer use. Urea fertilizer use is necessary during both the basal and follow-up fertilization phases. The nitrogen content in urea fertilizer is important for vegetative growth because it increases the root-shoot ratio, which determines bulb formation (Risaldi et al., 2021). However, using N in excess of requirements can cause stem thickening and bulb rot during storage (Geisseler et al., 2022).

NPK fertilizer has a significant effect, with an elasticity of 0.166, indicating that every 1% increase in NPK use increases production by 0.166% (ceteris paribus). The elasticity value of NPK fertilizer in the stochastic frontier production function is smaller than the elasticity value in the average production function. This indicates that NPK fertilizer use in the stochastic frontier function is less elastic than the elasticity in the average production function. Farmers can still increase the amount of NPK fertilizer. The highest production elasticity of NPK fertilizer indicates that this type of fertilizer plays a significant role in increasing garlic production. The macronutrients nitrogen, phosphorus, and potassium in NPK fertilizer contribute up to 80% to bulb formation in garlic and shallots (Shukla et al., 2018).

Family labor input has a significant effect, with an elasticity of 0.241. A 1% increase in family labor input can increase production by 0.241% (all other things being equal). This study aligns with the findings of Adzawla & Alhassan (2021). The elasticity of family labor input in the stochastic frontier production function is greater than the elasticity in the average production function. This indicates that land use in the stochastic frontier production function is more elastic than in the average production function. Garlic cultivation on Lombok Island is labor-intensive, as most cultivation phases are carried out by human labor. Research by Attipoe et al. (2020) states that labor has a positive and significant effect on output, although they do not differentiate between internal and external labor input.

The variables SP36 fertilizer, organic fertilizer, insecticide, and non-family labor did not significantly increase production. However, their positive coefficient values indicate that increasing the use of each variable can increase production, although not significantly. Farmers' use of organic fertilizer meets the recommended rate of 10,000 to 15,000 tons/ha.

The variables seed, fungicide, and herbicide had no significant effect on production. Their negative coefficient values indicate that increasing the use of these inputs will actually lead to a decrease in production, although not significantly. This is in contrast to the use of seeds, which is still insufficient or below the standard operating procedure (SOP). Both fungicides and herbicides are likely overused due to farmers' concerns about decreased production due to seed shortages, nutrient deficiencies, and weed infestation. This is evident in the average seed use of 436.75 kg per hectare, which is less than the recommended SOP of 600-1,500 kg per hectare. Continued pesticide additions do not significantly increase production due to other limiting factors, such as soil micronutrient content, as evidenced by the law of diminishing returns. The negative impact of seed use also occurred in study on garlic commodities in India (Karthick et al., 2015).

Technical Efficiency Level Analysis

The MLE method, in addition to identifying input factors that influence production, can also estimate technical efficiency. The average technical efficiency value achieved by farmers was 0.87, with the lowest value being 0.73 and the highest being 0.95. Most farmers achieved technical efficiency values in the range of 0.81-0.90. This average value indicates that there is still a 15% opportunity for farmers to increase their frontier production limits using the same technology. The variation in technical efficiency values achieved by farmers at the study sites reflects differing levels of technological mastery. Low technical efficiency reflects underuse of inputs, thus providing an opportunity to increase production by adding inputs. The distribution of technical efficiency values achieved by farmers is shown in Table 3.

Table 3. Estimated Technical Efficiency Value of Garlic Farmers on Lombok Island in 2025

Distribution of Technical Efficiency Values	Number of farmers	Percentage (%)
≤ 0.70	0	0.00
0.71 – 0.80	6	15.00
0.81 – 0.90	13	32.50
0.91 – 1.00	21	52.50
Total	40	100.00
Average Technical Efficiency	0.87	
Min	0.73	
Max	0.95	

The technical efficiency achieved by garlic farmers on Lombok Island of up to 87% is reasonable because most farmers are in the early adopter group (32%) and early majority (45%) in applying technology in the SOP. Farmers have implemented technological recommendations on planting, fertilization, input use, pest control, and recommended maintenance so that their farming is efficient. The use of some inputs such as pesticides, although still underused, provides profitable results for farmers because based on ROI analysis, garlic farming on Lombok Island can return revenues as much as 36 times the invested costs. Increasing the application of technological components in the SOP as one of the determinants of achieving technical efficiency needs to be done by improving the performance of extension services.

Limited farmer income prevents them from purchasing fertilizer in sufficient quantities for their crops, resulting in reduced plant nutrients. Fertilizer scarcity impacts garlic production and productivity due to the inability to meet the 6T principles of fertilization: the right type, the right amount, the right price, the right place, the right time, and the right quality (Kautsar et al., 2020). The mechanism for providing input subsidies to farmers requires evaluation in determining the type of assistance and recipients, as well as transparency in its distribution (Adila et al., 2022).

Studies on the technical efficiency of garlic farmers in various production centers in Indonesia have yielded mixed results. A study by Kurniasih et al. (2023) yielded a technical efficiency value of 0.85 for garlic farming in Temanggung Regency; the technical efficiency of garlic farmers in the Philippines reached 0.82 (Mina et al., 2021).

Factors Influencing Technical Inefficiency and Other Socioeconomic Factors on the Productivity Level of Garlic Farming on Lombok Island in 2025

The estimated results of the inefficiency function are shown in Table 4. Based on Table 4, the only factor significantly influencing technical inefficiency is the use of NPK fertilizer. A negative coefficient indicates that the addition of NPK fertilizer can reduce technical inefficiency.

Table 4. Results of the estimated inefficiency function using MLE for garlic production on Lombok Island in 2025

Variable	Parameter	Coefficient	Standard Error	T Value
Intercept	β_0	0.158[a]	0.014	10.801
Land Area	β_1	-0.079[ns]	0.079	-0.098
Seeds	β_2	-2.198[ns]	0.093	-0.237
Urea Fertilizer	β_3	-0.651[ns]	0.016	-0.406
ZA	β_4	0.071[ns]	0.050	1.426
NPK	β_5	-0.038[b]	0.016	-2.350
SP36	β_6	-0.249[ns]	0.029	-0.085
Organic fertilizer	β_7	-0.104[ns]	0.359	-0.029
Insecticide	β_8	0.588[ns]	0.067	0.870
Fungicide	β_9	-0.039[ns]	0.043	-0.935
Herbicide	β_{10}	0.032[ns]	0.038	0.822
Family Labor	β_{11}	0.072[ns]	0.067	1.074
Outside Family Labor	β_{12}	0.136[ns]	0.014	0.784

Notes: significant at level a (α 1%), b (α 5%) c (α 1%) ns: nonsignificant.

The addition of NPK fertilizer can reduce inefficiency because NPK fertilizer use by garlic farmers on Lombok Island is still relatively below recommendations. NPK fertilizer addition can increase yield potential by stimulating vegetative and generative growth, increasing plant resistance to drought and pest attacks, and helping to enlarge bulb size (Metuah et al., 2021). Available production inputs according to needs and recommendations can produce maximum output, thereby achieving technical efficiency (Saptana et al., 2021).

Factors that significantly reduced technical inefficiency included land area, seeds, urea fertilizer, organic fertilizer, SP36 fertilizer, and fungicides. Meanwhile, other factors that significantly increased inefficiency included ZA fertilizer, insecticides, herbicides, and family and non-family labor. A negative coefficient on land production inputs indicates that additional land can reduce technical inefficiency.

Seeds are a variable that can reduce technical inefficiency (Hidayati et al., 2015). Increasing the number of seeds is still possible to increase production, considering that seed use by garlic farmers on Lombok Island is still below the SOP recommendation (underused). The application of SP36 fertilizer also has a significant impact on reducing inefficiency. The influence of ZA fertilizer and organic fertilizer can increase inefficiency. This is because ZA fertilizer use exceeds the SOP recommendation. Long-term use of chemical fertilizers can lead to decreased soil fertility.

The addition of insecticides and herbicides also increases technical inefficiency. Sembalun District, Lombok Island, is a vegetable center. The use of chemical pesticides to control whitefly, stem borer, fusarium wilt, and other pests has exceeded the usage threshold. Increasing the number of seeds will not increase production due to the increased level of pest resistance.

This technical inefficiency function illustrates that at the farmer level two conditions exist in the use of production inputs. Some inputs with a positive coefficient are interpreted as being used beyond requirements or overused, thus increasing inefficiency. Meanwhile, input factors with a negative coefficient are associated with the use of production inputs that are still below requirements or underused. Socioeconomic factors influencing technical inefficiency were identified simultaneously using the MLE method on the Cobb-

Douglas production function. Table 5 shows in detail that only the farming experience variable significantly influences the technical inefficiency of garlic farming.

Table 5. Estimation Results of Factors Influencing Technical Inefficiency of Garlic Farming on Lombok Island in 2025

Variable	Parameter	Coefficient	Standard Error	T Value
Constants	δ_0	0.470^{ns}	1.005	0.468
Age	δ_1	0.914^{ns}	0.820	1.114
Education	δ_2	-2.261^{ns}	1.522	1.486
Experience	δ_3	-1.243^{a}	1.024	-2.914
Distance from home	δ_4	-0.583^{ns}	0.436	-1.337
Number of Dependents	δ_5	-0.368^{ns}	0.705	-0.522

Notes: significant at level a (α 1%), b (α 5%) c (α 1%) ns: nonsignificant.

The farming experience variable has a negative and significant effect at the 99% confidence level, with a coefficient of -1.243. The negative sign implies that the longer a farmer's experience in garlic farming, the lower their technical inefficiency, or the more efficient their farming (Kurniasih et al., 2023).

The age variable has a positive but insignificant effect on technical inefficiency. The older the farmer, the higher the level of inefficiency. The expected negative sign indicates that with increasing age, inefficiency increases. With age, a person's physical abilities decline, as does their ability to implement new technologies, which can reduce their farming efficiency (Kurniasih et al., 2023).

Formal education of garlic farmers negatively impacts technical inefficiency. Formal education negatively impacts technical inefficiency, meaning formal education reduces technical inefficiency in garlic farming. The higher a farmer's formal education, the lower the level of technical inefficiency (Aboaba, 2020; Mulyana et al., 2020).

The distance from the home to the program farmer's farmland negatively impacts technical inefficiency, meaning distance from the farmland reduces technical inefficiency. The further the distance from the home to the farmland, the lower the level of technical inefficiency. The estimated distance from the home to the farmland negatively impacts technical inefficiency, consistent with research by (Hernawati et al., 2023).

The variable number of dependents in a farmer's family negatively impacts technical inefficiency, but has no significant effect. The number of dependents in a family negatively impacts technical inefficiency, meaning the number of dependents in a family reduces technical inefficiency in garlic farming. The greater the number of household members, the less efficient the farming business is. The estimated variable number of dependents in a farmer's family negatively impacts technical inefficiency. Family responsibilities have a negative effect on technical inefficiency in line with research (Konja et al. 2019).

Conclusions

Factors that influence increasing garlic production are land area, urea fertilizer, ZA fertilizer, NPK fertilizer, and family labor. Input factors that significantly influence as risk inducing factors are ZA fertilizer, insecticides, herbicides, and labor within and outside the family. Input factors that significantly influence reducing technical inefficiency are NPK fertilizer. There are no input factors that significantly influence increasing technical inefficiency; The technical efficiency of garlic on Lombok Island reaches an average of 0.87, indicating that there is still a 13% opportunity for farmers to increase production to its frontier using existing technology; and Socioeconomic Factors that influence technical inefficiency in garlic farming on Lombok Island are influenced by garlic farming experience.

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Conflicts of Interest

The authors declare no conflict of interest.

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