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The Impact of the Effectiveness of Fertilizer Subsidy Policy Implementation on the Technical Efficiency of Corn Farmers in Pamekasan Regency

[1]Adjie Manggala Syahriyanda, [1*]Elys Fauziyah, [1]Dwi Ratna Hidayati, [1]Firman Farid Muhsoni, [1]Meria Zakiyah Alfisuma, [2]Sitti Aida Adha Taridala

[1]Faculty of Agriculture, Universitas Trunojoyo Madura, Jawa Timur, Indonesia
[2]Faculty of Agriculture, Universitas Halu Oleo, Kendari, Indonesia
*Correspondence Email: fauziyah@trunojoyo.ac.id

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ABSTRACT

The fertilizer subsidy policy is a government program aimed at providing affordable fertilizer to enhance the productivity of domestic commodities, including corn. In 2022, there was a change in the fertilizer subsidy policy, specifically a reduction in the number of subsidized fertilizer types and commodities. This policy change caused farmers to bear higher production costs. In addition, the decline in corn productivity at the research site serves as an indicator of the ineffectiveness of the fertilizer subsidy policy implementation and a source of production inefficiency. This study aims to evaluate the effectiveness of the 2022 fertilizer subsidy policy implementation and analyze its impact on the technical efficiency of corn farming. The research was conducted in Kadur Subdistrict, Pamekasan Regency, East Java. The study employed a survey method involving 43 farmers who were selected using a purposive sampling technique. Data analysis was performed using a quantitative descriptive approach, incorporating effectiveness analysis and technical efficiency measurement through the Cobb–Douglas Stochastic Frontier production function. The findings indicate that the effectiveness of the 2022 fertilizer subsidy policy implementation falls within the "highly effective" category. Furthermore, improving the effectiveness of non-Farmer Card (non-Kartu Tani) usage and the distribution of subsidized fertilizers significantly enhances technical efficiency.

Keywords*: agribusiness, effectiveness, efficiency, policy*

BACKGROUND

The agricultural sector in Madura, particularly in food commodities, relies heavily on the availability of fertilizer subsidies (Rahmaniyah & Rum, 2020). However, excessive application of chemical fertilizers beyond recommended usage limits can lead to the degradation of soil nutrients and a decline in soil fertility (Gerber, 2016). To address this issue, the government has implemented changes to the fertilizer subsidy policy, as outlined in PERMENTAN No. 10 of 2022 (Pratama, 2023). The enactment of this policy is expected to have significant implications for national food commodities, including those in Madura (Busthanul et al., 2023; Fauziyah et al., 2022).

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The fertilizer subsidy policy aims to positively impact farmers by increasing crop yields, strengthening the food security sector, and boosting farmers' incomes, particularly in the food crop sector (Jin et al., 2024; Takeshima & L. Tasie, 2015). Fertilizer subsidies help farmers mitigate risks by reducing production costs. As an illustration, the prices of non-subsidized urea and NPK fertilizers are Rp. 9,000/kg and Rp. 10,000/kg, respectively, while the subsidized prices for the two fertilizers are Rp. 2,250/kg and Rp. 2,300/kg. Consequently, farmers are more willing to take risks, enabling them to enhance production (Đokić et al., 2022). One approach to achieving this goal is through the establishment of a Maximum Retail Price (MRP) for subsidized fertilizers. This policy is designed to stabilize prices, ensuring farmers can access subsidized fertilizers at affordable rates (Busthanul et al., 2023; Takeshima & L. Tasie, 2015). According to Busthanul et al. (2023) despite its significant benefits, the government incurs substantial expenditures to meet the demand for subsidized fertilizers. Prior to 2022, the fertilizer subsidy allocation for 70 commodities and five types of fertilizers accounted for the largest share of the national budget (APBN), amounting to IDR 25,276.6 billion (Warr & Yusuf, 2014). As a result, frequent adjustments to the fertilizer subsidy policy have been necessary to balance its benefits and costs.

The 2022 fertilizer subsidy policy underwent significant changes. According to the Ministry of Agriculture, this change was made with consideration for the effectiveness and accuracy of the distribution of subsidized fertilizers. In addition, the change was also intended to optimize the use of the subsidy budget to support essential food programs. Beyond limiting subsidies to Urea and NPK fertilizers and nine specific commodities, the policy also introduced systemic adjustments. Fertilizer distribution now requires adherence to regulations concerning the RDKK (*Rencana Definitif Kebutuhan Kelompok* / Definitive Plan for Group Needs), *Kartu Tani* (Farmer Cards), distribution mechanisms, and the principles of subsidized fertilizer allocation. To purchase subsidized fertilizers, farmers must join farmer groups, collaboratively develop the RDKK, and receive guidance from agricultural extension officers (Rizal & Togimin, 2023).

In regions where *Kartu Tani* are implemented, these can be used to purchase subsidized fertilizers from authorized retailers. For areas without access to *Kartu Tani*, farmers can use the T-Pubers or REKAN applications to redeem subsidized fertilizers (Ministry of Agriculture, 2022). These policy adjustments aim to optimize the distribution of subsidized fertilizers, ensuring that farmers can easily access fertilizers through nearby channels. The policy's effectiveness is guided by the "6 Rights" principles: the right type, the right amount, the right time, the right place, the right price, and the right quality (Kholis & Setiaji, 2020). These principles serve as benchmarks for evaluating the effectiveness of subsidized fertilizer distribution. Evaluations focus on identifying areas where these principles have not been fully implemented (Kementerian Pertanian, 2022).

Several studies have examined the effectiveness of subsidized fertilizer distribution based on the "6 Rights" principles. Research by Kholis & Setiaji, (2020); Rigi et al., (2019) highlighted that implementing these principles ensures farmers receive subsidized fertilizers on time, in the appropriate quantity, type, and quality, particularly before the planting season begins. Their findings indicate that the principles of quality and price are critical factors requiring attention. Many farmers reported purchasing subsidized fertilizers at prices above the Maximum Retail Price (MRP) and, in

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some cases, receiving fertilizers of substandard quality, contrary to government regulations. Such issues categorize the distribution as ineffective.

Ineffectiveness arises when subsidized fertilizers are unavailable during the planting season, forcing farmers to delay their agricultural activities. Furthermore, the failure to fulfill other principles of the "6 Rights" also results in distribution inefficiencies (Adiraputra & Supyandi, 2021). Kholis & Setiaji (2020) deemed ineffective, potentially leading to a decline in agricultural production. This decline poses a threat to national food security and has broader economic implications. Fertilizer, being a vital input in agriculture, plays a crucial role in enhancing farming productivity (Alnaass et al., 2021; Vejan et al., 2021). Corn, as the second most important commodity after rice, faces high demand. Failure to meet the "6 Rights" principles negatively impacts farmers' economic stability, threatens national food security, and increases reliance on imported food commodities (Adhikari et al., 2021; Ghimire et al., 2023).

According to Prasetyo & Fauziyah (2020), one of the key regions supporting national corn production is Madura Island, part of East Java Province, which hosts several corn production centers. In 2018, corn from Madura contributed 10.5% to East Java's total corn production and 3.3% to the national total (BPS Jawa Timur, 2018). Despite a total national corn production of 14,460,601.32 tons, this figure still fell short of the 2023 national target of 16.98 million tons (National Food Agency, 2023). Pamekasan Regency, specifically Kadur Subdistrict, is one of the primary corn production areas in Madura, with a productivity rate of 7.02 tons per hectare in 2022 (KSA Kabupaten Pamekasan, 2022). Meanwhile, Larangan Subdistrict in the same regency recorded a slightly higher productivity rate of 7.62 tons per hectare during the same year (KSA Kabupaten Pamekasan, 2022). However, both areas have almost the same characteristics and are located adjacent to each other. These productivity differences are influenced by varying agroecosystem conditions, as each region has distinct characteristics, such as water availability in farming areas (Liu et al., 2022). The variations in productivity are believed to be affected by factors such as the size of the managed land, the types of seeds used, the application of fertilizers like Urea, NPK, and organic or manure-based fertilizers, the use of pesticides to control pests, herbicides to eliminate weeds that hinder nutrient absorption, and the allocation of labor in farming activities (Aboaba, 2020; Yusli & Fauziyah, 2020)

According to Kune et al. (2016), low agricultural productivity serves as an indicator of inefficiency, often caused by suboptimal use of production inputs. Optimal allocation of production inputs significantly impacts the productivity levels of farming activities. Maximum output can only be achieved when individuals or enterprises effectively implement the principles of production efficiency (Bibi et al., 2021; Kurnia et al., 2024). Low efficiency highlights sources of inefficiency that hinder productivity, leading to suboptimal results and increased production costs without proportional returns. High efficiency has substantial implications for farmers, particularly in developing countries, as part of broader development strategies (Ghimire et al., 2023). Factors contributing to low productivity often include inefficiencies stemming from farmers' age, education levels, farming experience, and involvement in farmer associations (Yusli & Fauziyah, 2020).

Additionally, Aboaba (2020; Selorm et al., (2023) identify other sources of inefficiency, such as the availability of savings and loan programs or cooperatives, access to infrastructure, and market connectivity. The effectiveness of subsidized fertilizer policy implementation is another critical factor

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influencing efficiency. Farjana & Khatun, 2020 demonstrate a strong correlation between production challenges in food crops and fertilizer subsidy policies, encompassing five key indicators, from the RDKK (*Rencana Definitif Kebutuhan Kelompok* /Definitive Plan for Group Needs) to the principles of fertilizer distribution. Based on these considerations, this study aims to measure the effectiveness of the 2022 subsidized fertilizer policy implementation and analyze its impact on the technical efficiency of corn farming in Kadur Subdistrict, Pamekasan Regency.

RESEARCH METHODS

This research was conducted from September to December 2024 in three villages: Kadur, Bungbaruh, and Kertagenah Tengah, located in Kadur Subdistrict, Pamekasan Regency. The research site was purposefully selected based on the consideration that Kadur Subdistrict is one of the primary corn production centers in Pamekasan Regency. According to data from BPS (Statistics Indonesia), Kadur Subdistrict contributed 12,635 tons of corn production in 2022 (KSA Kabupaten Pamekasan, 2022).

The samples were selected using purposive sampling, focusing on active corn farmers who are members of farmer groups (Taherdoost, 2016). This method was chosen to ensure the inclusion of samples that meet the research criteria and objectives. A total of 43 samples were obtained, consistent with Gay & Diehl, (1992) recommendation that a sample size of approximately 30 participants is sufficient for statistical analysis.

Primary data were collected through interviews and/or observations with each respondent. Interviews were conducted based on Adhabi & Anozie (2017) approach, which involves direct or indirect face-to-face interactions between the interviewer and respondents as sources of information. Observations followed Bourenkov & Popov (2006) guidelines, utilizing visual perception as the primary tool for gathering data, supported by other sensory inputs.

This research employs a quantitative approach for data analysis. The first objective, the effectiveness of the 2022 subsidized fertilizer policy was evaluated using five indicators: RDKK (*Rencana Definitif Kebutuhan Kelompok* (Definitive Plan for Group Needs)), *Kartu Tani* (Farmer Card), Non-*Kartu Tani* (Non-Farmer Card) mechanisms, Distribution of Subsidized Fertilizer, and the Principles of Subsidized Fertilizer Distribution (Ministry of Agriculture, 2022; Kholis & Setiaji, 2020; Rigi et al., 2019). The use of a 1–3 scale was chosen considering its limited range of options, which helps reduce bias. In addition, the smaller variation makes it easier to analyze when dealing with a large sample size (Preston, 2020).

After calculating the percentage for each indicator, effectiveness scores were categorized to assess the overall effectiveness of the subsidized fertilizer policy for corn farmers in Kadur Subdistrict (Kholis & Setiaji, 2020). The second objective was analyzed using the Cobb-Douglas stochastic frontier production function with Maximum Likelihood Estimation (MLE). This method evaluated the impact of the effectiveness of the subsidized fertilizer policy on the technical efficiency of corn farmers in Kadur Subdistrict (Ndubueze-ogaraku & Graves, 2012; Okello et al., 2019; Prasetyo & Fauziyah, 2020).

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As an assessment of the level of effectiveness in policy implementation, a ranking is then conducted based on the various levels of policy effectiveness, using measurement indicators (Kholis & Setiaji, 2020; Ortiz & Leal, 2020; Rigi et al., 2019).

Table 1. Effectiveness Score Interpretation

Effectiveness Score	Interpretation of Effectiveness
0% - <25%	highly Ineffective
25% - <50%	ineffective
50% - <75%	effective
75% - 100%	highly effective

The stochastic frontier production function is used to evaluate and estimate production efficiency in agricultural enterprises based on inputs and the factors influencing them, both internal and external, simultaneously (Aigner et al., 1977). The Cobb-Douglas stochastic frontier production function using Maximum Likelihood Estimation (MLE) is written as follows:

$$\text{Ln } Y=\beta_0+\beta_1 \text{ Ln } X_1+\beta_2 \text{ Ln } X_2+ \beta_3 \text{ Ln } X_3+ \beta_4 \text{ Ln } X_4+ \beta_5 \text{ Ln } X_5+ \beta_6 \text{ Ln } X_6+ (vi-ui)$$

Key:

Y = Corn production
X1 = Amount of corn seeds used (Kg)
X2 = Amount of Urea fertilizer used in corn farming (Kg)
X3 = Amount of NPK fertilizer used in farming (Kg)
X4 = Amount of organic or manure fertilizer used in corn farming (Kg)
X5 = Amount of labor (HOK)
X6 = Amount of insecticides used in corn farming (Ml)
$\beta 0$ = *Intercept/Constant*
β_1- β_6 = Regression coefficients
vi = Systematic error component, a symmetric, normally distributed random error or model random,
ui = *one-side error term* (Ui ≥ 0) or technical inefficiency

This model can be used to analyze the model (ui), which represents the sources of technical inefficiency. The model is written as follows:

$$ui = \delta_0+ \delta_1 Z_1+\delta_2 Z_2+\delta_3 Z_3+\delta_4 Z_4+\delta_5 Z_5+\delta_6 Z_6+\delta_7 Z_7+ \delta_6 Z_8+ \delta_8 Z_8+ \delta_9 Z_9+ei$$

Key:

Z1 = Age (years)
Z2 = Experience in farming (years)
Z3 = Education level (years)
Z4 = frequency of extension visits
Z5 = Irrigation system (1=technical; 2=non-technical)
Z6 = Policy effectiveness score for the *Kartu Tani* indicator
Z7 = Policy effectiveness score for the non-*Kartu Tani* indicator
Z8 = Policy effectiveness score for the subsidized fertilizer distribution indicator

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Z9 = Policy effectiveness score for the subsidized fertilizer distribution principle indicator
ui = Technical inefficiency effect
δ0 = Constant
δ1- δ10 = Estimated parameter coefficients

In interpreting all variables and analyzing their impact on production, the first step is to evaluate whether the data processed can be considered suitable for analysis and interpretation. The initial step involves comparing the Log likelihood function values between MLE and OLS. If the Log likelihood value of MLE is greater than that of OLS, the data is considered suitable for further analysis (Ginting et al., 2023).

RESULT AND DISCUSSION

The characteristics of farmers in Kadur District are largely in the productive age group, with 58% of farmers aged between 41-60 years. A significant proportion (69%) have completed elementary education, though many also attended high school or earned a university degree while engaging in farming activities. Regarding participation in extension activities, 60% of farmers have attended at least one extension session, indicating an awareness of the importance of self-capacity development. In terms of farming experience, the majority (67%) have over 20 years of experience, suggesting that they possess both practical skills and knowledge in managing corn farming.

Effectiveness of Subsidized Fertilizer Policy in 2022 in Kadur District, Pamekasan Regency

The effectiveness of the implementation of the subsidized fertilizer policy in 2022 was assessed based on five indicators: RDKK (Rencana Definitif Kebutuhan Kelompok / Definitive Plan for Group Needs), Kartu Tani, Non-Kartu Tani, Distribution, and Principles of Distribution. The general results from the field data analysis are presented in Figure 1.

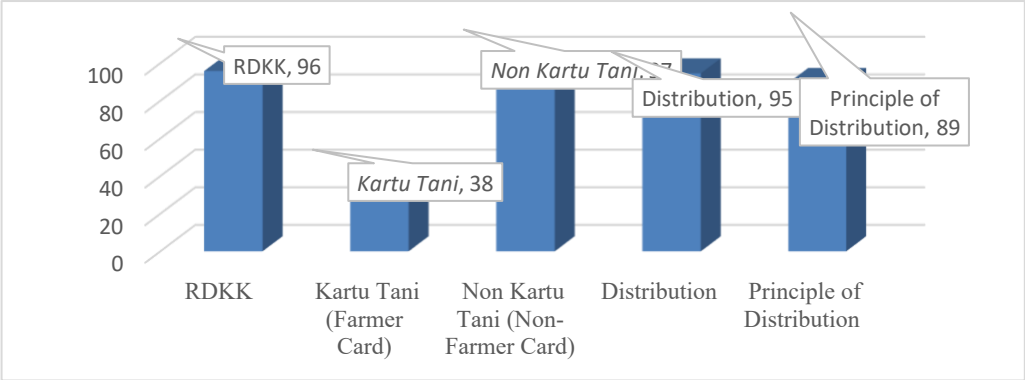

Figure 1. Effectiveness of Subsidized Fertilizer Policy Implementation in 2022

The first parameter to assess the effectiveness of the subsidized fertilizer policy, RDKK (*Rencana Definitif Kebutuhan Kelompok* / Definitive Plan for Group Needs), is presented in Table 3. The overall effectiveness scores for each parameter indicate that the subsidized fertilizer policy's effectiveness on the RDKK indicator in Kadur District is at a very effective level. Data analysis shows

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that the implementation of the RDKK system achieved an effectiveness level of 96%. This achievement suggests that the planning of fertilizer needs through RDKK has been carried out very well. However, there are some farmer groups that are less active in conducting RDKK meetings every year, thus using the RDKK from the previous year. This aligns with Wulandari (2024) research, which analyzed the distribution of subsidized fertilizer in Lubuk Tarok District, where similar findings were found. Although the preparation of RDKK was categorized as effective, the process was less supported by agricultural extension services.

Table 2. Effectiveness of RDKK (*Rencana Definitif Kebutuhan Kelompok* / Definitive Plan for Group Needs) Parameters

No	Indicator	Average Score	Effectiveness Level (%)	Category
1	Changes in subsidized fertilizer policies are well and clearly socialized by the relevant authorities	2,97	99	Highly Effective
2	Farmers are actively involved in the preparation of RDKK by their group	2,7	93	Highly Effective
3	Preparation of RDKK is supported by agricultural extension workers	2,9	98	Highly Effective
4	Farmers are aware of the required components in RDKK preparation, including: a. RDKK of the previous year b. Plans for subsidized fertilizer RDKK c. Data on land area and ownership	2,8	95	Highly Effective
5	Farmers are aware of the RDKK draft produced during the meetings	2,8	94	Highly Effective
Total		14,3	479	Highly Effective
Average		2,87	96	

The second parameter used to measure the effectiveness of the fertilizer subsidy policy is the *Kartu Tani* (Farmer's Card), as shown in Table 4. The calculated effectiveness of the *Kartu Tani* parameter indicates a low level of effectiveness. Three out of five parameters received low scores, with an average effectiveness of 36%. Farmers in Kecamatan Kadur were unable to use the *Kartu Tani* program even to redeem subsidized fertilizers, opting instead for alternative methods. This has led to the system being perceived as a failure, as it is neither functional nor inclusive of all farmers. The scores for each indicator suggest that the effectiveness of the subsidized fertilizer policy, as measured by the *Kartu Tani* indicator in Kecamatan Kadur, falls within the "ineffective" category, with an average score of 38%.

The implementation of the *Kartu Tani* program has produced unsatisfactory results, with an effectiveness level of only 38%. This low effectiveness reflects various challenges and barriers to implementing an integrated system within the agricultural sector, particularly one linked to banking

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services. As highlighted by Ashari & Hariani (2019), one of the primary obstacles to the program's success is the lack of adequate resource preparedness. Additional hindering factors include the system's inability to cover all farmers (Goffar & Agustin, 2021). overly burdensome requirements for farmers to use the system, insufficient dissemination of clear information about the card's benefits, and a failure to convince farmers to adopt a banking-integrated system (Marhaeni et al., 2024).

Table 3. Effectiveness of *Kartu Tani* (Farmer Card) Parameters

No	Indicator	Average Score	Effectiveness Level (%)	Category
1	Farmers are aware of the fertilizer distribution process using Farmer Card (*Kartu Tani)*	1,5	50	Effective
2	Farmers have used *Kartu Tani* to obtain subsidized fertilizers	1	36	Ineffective
3	Farmers obtained Farmer Card (*Kartu Tani*) easily	1,02	36	Ineffective
4	Farmers can easily use Farmer Card (*Kartu Tani*) at the level of fertilizer retailers	1,16	36	Ineffective
5	Fertilizer distributors assist farmers with (*Kartu Tani*) Farmer Card-related issues	1	40	Ineffective
Total		5,69	190	Ineffective
Average		1,1	38	

The third parameter for assessing the effectiveness of the fertilizer subsidy policy, namely the non-Kartu Tani program, is presented in Table 4. Indicators for the *non-Kartu Tani* program, based on two parameters, demonstrate high effectiveness. Farmers in Kadur District can access subsidized fertilizers easily and quickly through this program. This policy allows farmers to purchase subsidized fertilizers by simply presenting their ID card (KTP) and family card (KK) as requirements for redemption. Unlike the *Kartu Tani* program, this initiative is widely used by farmers in Kadur District because it is perceived as straightforward, quick, and does not require any involvement with banking systems According to Adiraputra & Supyandi (2021), Adiraputra & Supyandi (2021) ease of access to fertilizers is a critical factor in ensuring the sustainability of agricultural practices. The values for each parameter indicate that the effectiveness of the subsidized fertilizer policy, under the non-Kartu Tani indicator in Kadur District, is categorized as effective, with a score of 97%.

A notable finding is observed in the Non-*Kartu Tani* (Non-Farmer Card) variable, which demonstrates a remarkably high effectiveness level of 97%. This indicates that the conventional system for distributing subsidized fertilizers remains highly effective and well-received by farmers in Kadur District. This phenomenon aligns with the research by Lazuardi et al. (2024) which revealed that most farmers prefer not to use the *Kartu Tani* due to inadequate infrastructure and instead opt for the non-*Kartu Tani* scheme to redeem subsidized fertilizers. This preference is attributed to the simplicity and ease of use of the non-*Kartu Tani* system compared to the *Kartu Tani*, which often requires farmers to fulfill cumbersome prerequisites.

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Table 4. Effectiveness of Non-*Kartu Tani* (Non-Farmer Card) Parameters

No	Indicator	Average Score	Effectiveness Level (%)	Category
1	Farmers individually obtain fertilizers easily using the T-Pubers application	2,9	97	Highly Effective
2	Farmers collectively obtain fertilizers easily using the Rekan application	2,9	98	Highly Effective
Total		5,83	195	Highly Effective
Average		2,91	97	

The fourth parameter for measuring the effectiveness of the fertilizer subsidy policy is the distribution process, as outlined in Table 5. This process refers to the distribution of government-subsidized fertilizers to farmers. According to Paudel & Crago (2017) the ease with which farmers can access fertilizers, in the required quantities, plays a crucial role in agricultural sustainability. The effectiveness scores for subsidized fertilizer distribution are presented in Table 5.

The indicators for subsidized fertilizer distribution, based on four parameters, exhibit high effectiveness levels. Farmers in Kadur District can easily reach official kiosks to redeem fertilizers due to the proximity and accessibility of these locations. Fertilizer distributors are reliable in providing fast and efficient service. If farmers bring the required documents, such as an ID card (KTP) and family card (KK), the redemption process is swift. Additionally, farmer groups offer solutions for those unable to visit the official kiosks by delivering subsidized fertilizers from the kiosks to the group leaders' homes. Farmers can then visit the group leaders' homes to complete the fertilizer redemption process.

The scores for each parameter indicate that the subsidized fertilizer policy's effectiveness in the distribution process in Kadur District is at an effective level, with a score of 95%. This demonstrates that the distribution of subsidized fertilizers, from producers to farmers, has been highly efficient and well-executed.

Table 5. Effectiveness of Subsidized Fertilizer Distribution Parameters

No	Indicator	Average Score	Effectiveness Level (%)	Category
1	Accessibility of subsidized fertilizer distributors/retailers near farmers	2,9	98	Highly Effective
2	Ease and simplicity of service provided by fertilizer distributors	2,9	98	Highly Effective
3	Clarity of information provided by distributors about subsidized fertilizers	2,6	88	Highly Effective
4	Reliability of distributors in serving farmers	2,8	94	Highly Effective
Total		11,34	378	
Average		2,83	95	

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The fifth parameter for measuring the effectiveness of the subsidized fertilizer policy is the principles of distribution, which serve as fundamental guidelines to ensure that fertilizer distribution adheres to the six "rights" of distribution. The effectiveness values for the principles of subsidized fertilizer distribution are presented in Table 6.

The indicators for the principles of subsidized fertilizer distribution, based on seven parameters, demonstrate that the effectiveness of these principles falls under the "effective" category. For the parameter of "right price," the effectiveness reached 88%. This result stems from the fact that farmers purchased subsidized fertilizer at a price of Rp. 125,000 per 50 kg, which exceeds the regulated retail price (HET) of Rp. 112,500 per 50 kg. This discrepancy indicates a price difference of Rp. 12,500 between the HET and the actual price paid by farmers.

The "right quality" parameter scored 67%, reflecting farmers' perceptions in Kadur District that the efficacy of the fertilizers has diminished, with reduced fertilization effects. This perception is primarily attributed to soil exhaustion caused by the prolonged use of chemical fertilizers over time. Conversely, the parameter assessing the absence of additional costs for farmers scored highly, as farmers were not required to pay extra fees to obtain subsidized fertilizer. Farmers only needed to pay the official price set by authorized retailers.

The overall effectiveness of the subsidized fertilizer policy based on the principles of distribution in Kadur District was rated as highly effective, with a score of 89 %. These findings contrast with the study by Busthanul et al. (2023), which evaluated the effectiveness of subsidized fertilizer policies in Wajo District and found the "four rights" principles achieved an effectiveness percentage of 46.46%, categorizing it as moderately effective.

Table 6. Effectiveness of the Principles of Subsidized Fertilizer Distribution

No	Indicator	Average Score	Effectiveness Level (%)	Category
1	Farmers receive subsidized fertilizer meeting the right type	2,7	91	Highly Effective
2	Farmers receive subsidized fertilizer meeting the right amount or quantity	2,7	91	Highly Effective
3	Farmers receive subsidized fertilizer meeting the right timing	2,8	94	Highly Effective
4	Farmers receive subsidized fertilizer at the right place or location	2,9	98	Highly Effective
5	Farmers purchase subsidized fertilizer at the right price	2,6	88	Highly Effective
6	Farmers receive subsidized fertilizer of the right quality	2	67	Effective
7	Farmers do not pay additional fees to obtain subsidized fertilizer	2,9	97	Highly Effective
Total		18,79	627	Highly Effective
Average		2,68	89	Highly Effective

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Based on the effectiveness scores from the five parameters analyzed, the overall effectiveness level of the subsidized fertilizer policy in Kadur District in 2022 was determined. The average effectiveness score across the five indicators was 83.4%. This score places the subsidized fertilizer policy in Kadur District within the category of 75% to 100%, indicating that the policy was highly effective. A detailed breakdown of the effectiveness of the subsidized fertilizer policy in Kadur District for 2022 is presented in Table 7.

Table 7. Effectiveness of the Subsidized Fertilizer Policy in 2022

No	Indicator	Effectiveness Level (%)	Category
1	RDKK (*Rencana Definitif Kebutuhan Kelompok* (Definitive Plan for Group Needs))	96	Highly Effective
2	Farmer Card *(Kartu Tani)*	38	Ineffective
3	Non-Farmer Card *(non-Kartu Tani)*	97	Highly Effective
4	Subsidized Fertilizer Distribution	95	Highly Effective
5	Principles of Subsidized Fertilizer Distribution	89	Highly Effective
	Total	417	
	Average	83,4	Highly Effective

Impact of the 2022 Fertilizer Subsidy Policy Effectiveness on the Technical Efficiency of Corn Farming in Kadur Subdistrict

In an effort to optimize corn farming productivity in Kadur Subdistrict, technical efficiency analysis becomes crucial to identify the factors influencing production performance (Kurnia et al., 2024). In the analysis of the stochastic frontier production function, understanding the factors that influence production is the first step in identifying technical efficiency. The results of the analysis of the effect of input use on corn production in Kadur Subdistrict are presented in detail in Table 8.

Table 8. Results of the Analysis of the Effect of Input Use on Corn Farming Production

Variable		Coefficient	t-Ratio	Description
Constant		4,605	5,219	
Corn Seed Quantity (kg)	X1	-0,250	-1,665	**
Urea Fertilizer Quantity (kg)	X2	0,317	1,685	**
NPK Fertilizer Quantity (kg)	X3	-0,010	-0,071	Ns
Manure Quantity (kg)	X4	-0,142	-1,483	**
Labor (HOK)	X5	0,817	4,018	*
Insecticide Quantity (ml)	X6	-0,004	-0,165	Ns
Sigma-Squared	Ơ2	0,336	5,339	*
Gamma	Ɣ	0,283	3,993	*
OLS log-likelihood		- 40,00		
MLE log-likelihood		- 33,10		
LR test		13,81		

Source: Primary Data from Research 2024 (Processed)

Key:

* : Significant at α = 5% (t-table = 1.688)

** : Significant at α = 10% (t-table = 1.305)

Ns : Not significantly affected

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The results of the Cobb-Douglas Stochastic Frontier production function analysis are considered appropriate for predicting the impact of the 2022 Fertilizer Subsidy Policy effectiveness on the technical efficiency of corn farming in Kadur Subdistrict. This is indicated by the MLE log-likelihood value being higher than the OLS log-likelihood value. If the MLE log-likelihood value is greater than the OLS log-likelihood value, it can be concluded that the data used are suitable for the Cobb-Douglas Stochastic Frontier production function model (Kurnia et al., 2024; Yusli & Fauziyah, 2020). The estimation results show that the Gamma t-ratio value of 3.993 is higher than the t-table value at the 95% confidence level, indicating that the production error is primarily caused by technical inefficiency factors.

Table 8 presents the production input variables that significantly affect corn production in Kadur District: the quantity of corn seeds (X1), the use of urea fertilizer (X2), the quantity of manure (X4), and the amount of labor in HOK units (X5). Conversely, the variables such as the quantity of corn seeds (X1), NPK fertilizer (X3), manure (X4), and insecticide (X6) do not significantly affect corn production in Kadur District.

The first significant production factor is the amount of corn seed used in corn farming activities. The use of corn seeds is negatively correlated with corn production in Kadur District. This finding indicates that an increase of 1% in the amount of corn seeds used will decrease corn production by 2.5%. This suggests that an excessive number of seeds is being used for a given area of land. In practice, using too many seeds could lead to excessive plant density. According to Donald C. M., (1958), if too many seeds are planted in one area, the plants will compete for light, water, and nutrients, which can hinder growth and yield. This finding is in line with Kune et al., (2016), who also observed a negative correlation between seed quantity and production.

The next significant production factor is the amount of urea fertilizer used in corn farming activities. The use of urea fertilizer is positively correlated with corn production in Kadur District. This finding suggests that a 1% increase in the use of urea fertilizer will increase corn production by 3.17%. On average, farmers in Kadur District use 199 kg/ha of urea fertilizer per hectare, which is still below the recommendation of the Agricultural Research and Development Agency (Badan Penelitian dan Pengembangan Pertanian, 2020), which is 350 kg/ha. This means that corn production can still be increased since the use of urea fertilizer can be raised to enhance productivity. According to Barlog et al. (2022), applying fertilizer can significantly impact the quality and quantity of crops. Junaedi et al. (2023) also found that the availability of nutrients in adequate amounts determines plant growth outcomes.

The next production factor significantly affecting corn production is the amount of manure used in farming activities. The use of manure is negatively correlated with corn production in Kadur District. This finding indicates that a 1% increase in the amount of manure used will decrease corn production by 1.42%. This suggests that the amount of manure applied may have reached an optimal or excessive level. On average, farmers use 916 kg/ha of manure, which might exceed the plant's needs. If not based on soil analysis, this can lead to the accumulation of nutrients, particularly nitrogen, which hampers flowering and reduces yield. Moreover, excessive use of fertilizer can damage soil structure, reduce aeration and drainage, and increase the risk of pests and diseases, which

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further decreases production. These findings underscore the importance of effective fertilizer management and the application of proper agronomic practices. Farmers need to receive training on ideal fertilizer dosages to ensure sustainability and productivity in corn farming. These findings are consistent with Kune et al., (2016), who also found a negative correlation with manure use

The next significant production factor, which has a positive correlation with corn production, is the allocation of labor in corn farming activities. This finding suggests that a 1% increase in labor allocation in HOK units will increase corn production by 8.17%. This result shows that the labor allocation used is not intensive enough and should be increased. By adding more labor, corn production in Kadur District can be improved. According to Indrianingsih et al., 2023, labor allocation needs to be measured properly to match the workload. If there is a shortage or excess, it will result in different production outcomes. Junaedi et al., (2023) also argued that labor is a critical factor influencing agricultural production.

Table 9. Technical Efficiency of Corn Farmers in Kadur Subdistrict

Technical Efficiency Level	Number of Farmers	Percentage (%)
≤ 0.50	7	16
0.51 – 0.60	2	5
0.61 – 0.70	3	7
0.71 – 0.80	4	9
0.81 – 0.90	10	23
0.91 – 1.00	17	40
Total	43	100
Average	0.783	
Maximum	0.965	
Minimum	0.159	

Source: Primary data, processed 2024

The findings on technical efficiency highlight the management of production input factors by farmers that influence their levels of technical efficiency. Technical efficiency values range between 0 and 1. According to Bempomaa & Acquah, (2014), farming is considered technically efficient when the Technical Efficiency (TE) value exceeds 0.8. The distribution of technical efficiency for corn farming in Kadur Subdistrict is presented in Table 9.

The analysis indicates that 37% of corn farmers in Kadur are not yet technically efficient, while 63% have achieved technical efficiency. The average TE score among farmers is 0.783, with the lowest and highest values being 0.159 and 0.965, respectively. Variations in technical efficiency among farmers are attributed to differences in the amount of input factors utilized in farming activities. Factors contributing to inefficiency are suspected to include the age of the farmers, farming experience, educational level, frequency of agricultural extension services, irrigation systems, and the effectiveness scores of the 2024 fertilizer subsidy policy.

The average TE level for corn farming in Kadur Subdistrict is comparable to findings by (Fauzan et al., 2023), which reported an average TE of 0.720. This relatively high average, approaching the optimal value of 1, suggests that farmers in Kadur need to further enhance their productivity and technical efficiency. To understand the factors contributing to technical inefficiency

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in corn farming in Kadur Subdistrict, this study analyzed various socio-economic variables and the effectiveness scores of the 2022 fertilizer subsidy policy. The results of the analysis on the influence of various factors contributing to technical inefficiency in corn farming in Kadur Subdistrict are presented in Table 10.

Table 10. Results of Analysis on Factors Influencing Technical Inefficiency in Corn Farming

Variable		Coefficient	t-Ratio	Description
Constant				
Farmer's age	Z1	-0,079	-2,340	*
Farming experience	Z2	0,023	0,813	Ns
Education	Z3	-0,273	-2,340	*
Frequency of extension	Z4	0,939	3,537	*
Irrigation system	Z5	-0,423	0,755	Ns
*Kartu Tani (*Farmer Card) effectiveness score	Z6	0,004	-0,016	Ns
*Non-Kartu Tani (*Non-Farmer Card*)* effectiveness score	Z7	-0,151	3,830	*
Subsidized fertilizer distribution effectiveness score	Z8	-0,032	-1,791	*
Principles of subsidized fertilizer distribution effectiveness score	Z9	0,004	0,251	

Source: Processed Primary Data, 2024
Key:
* : Significant at α 5% (t table = 1,688)
** : Significant at α 10% (t table = 1,305)
Ns : Not Significant

The estimation of technical inefficiency in corn farming in Kadur District, as shown in Table 11, identifies significant sources of inefficiency. These include farmer's age (Z1Z_1), education level (Z3Z_3), frequency of extension services (Z4Z_4), the effectiveness score of Non-Farmer Cards (Z7Z_7), and the effectiveness score of subsidized fertilizer distribution (Z8Z_8). Conversely, farming experience (Z2Z_2), the irrigation system (Z5Z_5), the effectiveness score of Farmer Cards (Z6Z_6), and the effectiveness score of principles governing subsidized fertilizer distribution (Z9Z_9) were found to have no significant effect.

This study excludes the effectiveness of RDKK (Definitive Plan for Group Needs) as a source of inefficiency due to its non-normal data distribution. The lack of normality is attributed to questionnaire responses for RDKK indicators being consistently high, with values of 92, 93, and 99, failing to meet the assumptions of normal distribution. According to Aigner et al., (1977) inefficiency sources (uiu_i) are assumed to follow a half-normal distribution. Furthermore, Kea & Shahriar (2023) suggest that including non-normally distributed data in the model can reduce the validity of other variables used in the analysis.

The first significant source of inefficiency is the age of the farmers. This variable demonstrates a negative relationship, with a t-ratio value of -2.340, exceeding the critical t-table value at a 5% error

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level (2.340 > 1.688). This result indicates that as farmers age, inefficiency decreases. In other words, older farmers tend to manage their farming operations more efficiently. Older farmers may be more selective in adopting new technologies. While this cautious approach could be seen as a limitation, they are more likely to implement technologies that have been proven effective over time. This minimizes the risk of failure and enhances efficiency. Additionally, older farmers tend to excel in resource management, including land, water, and fertilizers. Their experience enables them to utilize these resources optimally, reducing waste and improving yields.This finding aligns with the study by Tumuri et al. (2024), which also identified the age variable as having a significant and negative impact on technical inefficiency.

The second significant source of inefficiency is the education level of farmers. This variable exhibits a negative relationship, with a t-ratio value of -2.340 exceeding the critical t-table value at a 5% error level (2.340 > 1.304). This finding indicates that as farmers' education levels increase, inefficiency decreases. In other words, farmers with higher levels of education are better equipped to manage maize farming operations more efficiently. Higher education provides farmers with several advantages in agricultural practices. Educated farmers have broader access to information. They are more proactive in seeking the latest information on maize cultivation, possess wider information networks, and are better equipped to access and comprehend agricultural research findings that can be applied to their farming activities. Additionally, educated farmers demonstrate stronger management and bookkeeping skills, which allow for more systematic and efficient farm operations. These advantages enable educated farmers to reduce inefficiencies and enhance their productivity, as reflected in the inverse relationship between education levels and inefficiency. This study aligns with the findings of Wang & Hu (2021), which suggest that higher education levels among farmers significantly improve their technical efficiency in maize farming. Similarly, Sumane et al. (2018) emphasize that farmers with greater knowledge and experience are more likely to achieve sustainable farming practices.

The third significant source of inefficiency is the frequency of agricultural extension participation, which exhibits a positive relationship, as indicated by a t-ratio value of 3.537, exceeding the critical t-table value at a 5% error level (3.537 > 1.688). This finding suggests that more frequent participation in extension activities correlates with increased inefficiency. This outcome is reflected in the low average technical efficiency among farmers who attended extension programs more than once (an average of 2–3 attendances). This inefficiency is associated with farmers' tendencies to attend these activities merely as a formality, which does not necessarily guarantee an improvement in their understanding or willingness to implement the materials or technologies introduced during the sessions. Furthermore, factors such as relatively low education levels or varying levels of farming experience among participants hinder optimal information absorption. A frequent disconnect exists between the orientations of extension agents and farmers. While extension programs emphasize technical aspects aimed at enhancing productivity and efficiency, farmers often prioritize practical considerations, such as ease of implementation and risk minimization. This misalignment can result in farmers being less inclined to fully adopt the recommendations provided, ultimately contributing to technical inefficiency.

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Future studies could refine the frequency variable by incorporating factors such as the level of understanding and the degree of implementation of the technologies presented during agricultural extension programs. Field evidence indicates that farmers achieving a technical efficiency score greater than 0.8 typically attend extension activities only once per growing season. This phenomenon aligns with findings by Bhatt & Bhat (2014), which highlight that the relationship between farmers' knowledge levels and technical efficiency is nonlinear. Specifically, technical efficiency tends to increase with initial knowledge acquisition but may decline once a knowledge saturation point is reached.

The fourth significant source of inefficiency is the effectiveness of the non-*Kartu Tani* (non-Farmer Card) scheme, which exhibits a positive relationship, as indicated by a t-ratio of 3.830, exceeding the critical t-table value at a 5% error level (3.830 > 1.688). This finding suggests that the non-*Kartu Tani* (non-Farmer Card) scheme effectively reduces technical inefficiency. This is linked to the challenges associated with the *Kartu Tani* (Farmer Card) system, which complicates access for farmers. In contrast, the non-Kartu Tani system provides an alternative mechanism, enabling farmers to obtain their rights to subsidized fertilizers more efficiently. The high effectiveness of the non-*Kartu Tani* (non-Farmer Card) scheme in Kadur Subdistrict has contributed to increased maize production, as it facilitates easier access for farmers to purchase subsidized fertilizers required for their farming activities. Supporting this finding, data indicate that the effectiveness of the *Kartu Tani* (Farmer Card) system is notably low, with farmers unable to utilize the cards to acquire subsidized fertilizers. Field observations further corroborate this, revealing that no farmers in the region could use the *Kartu Tani* (Farmer Card) system. According to Ashari & Hariani, (2019), resource limitations are a critical barrier to the effectiveness of the *Kartu Tani* (Farmer Card) program. These resources include program budgets and the government's lack of preparedness to implement and facilitate the system effectively, which have hindered the program's success.

The fifth significant source of inefficiency is the effectiveness of subsidized fertilizer distribution, which demonstrates a negative relationship with a t-ratio of -1.797, exceeding the critical t-table value at a 5% error level (1.797 > 1.688). This finding indicates that an increase in the effectiveness of subsidized fertilizer distribution reduces technical inefficiency. This condition arises because when farmers can easily access fertilizers, they can commence their farming activities on time, thereby improving production outcomes and reducing inefficiencies associated with the unavailability of fertilizers. The findings are further supported by data showing a high level of effectiveness in the principles of fertilizer distribution.This result aligns with the research of Kholis & Setiaji (2020) which concluded that fertilizer distribution through kiosks has been implemented effectively.

CONCLUSION AND SUGGESTION

The findings from research conducted in Kadur District, Pamekasan Regency, on corn farming reveal that, based on the indicators of RDKK (*Rencana Definitif Kebutuhan Kelompok* (Definitive Plan for Group Needs / Definitive Plan for Farmer Group Needs), *Kartu Tani* (Farmer Cards), *Non-Kartu Tani* (non-Farmer Cards), subsidized fertilizer distribution, and principles of subsidized

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fertilizer distribution, the effectiveness of the implementation of fertilizer subsidy policies in 2022 is classified as effective. Among these indicators, the effectiveness of non-Farmer Cards and subsidized fertilizer distribution significantly influences the level of technical inefficiency. There remains an opportunity to enhance the effectiveness of fertilizer subsidy policies. This can be achieved by improving the quality consistency of fertilizers due to the declining efficacy of chemical fertilizers caused by prolonged use. The adoption of organic fertilizers presents a potential solution to address the reduced effectiveness of chemical fertilizers (Sulaminingsih, 2024). Agricultural extension workers and farmer groups are encouraged to introduce and mandate the use of organic fertilizers among farmers. Quality consistency can also be improved if agricultural extension programs address the declining effectiveness of chemical fertilizers, thereby enhancing the quality consistency and increasing corn production. The limitation of this research lies in the use of the variable "frequency of extension" which lacks specificity. Future studies should elaborate this variable into "level of understanding" and "level of implementation of the technology" delivered by agricultural extension workers to achieve more precise results.

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REFERENCES

Aboaba, K. (2020). Economic Efficiency of Rice Farming: *Journal of Agribusiness and Rural Development*, *58*(4).

Adhabi, E., & Anozie, C. B. (2017). Literature Review for the Type of Interview in Qualitative Research. *International Journal of Education*, *9*(3), 86. https://doi.org/10.5296/ije.v9i3.11483

Adhikari, J., Shrestha, M., & Paudel, D. (2021). Nepal's growing dependency on food imports: A threat to national sovereignty and ways forward. *Nepal Public Policy Review*, *1*.

Adiraputra, P., & Supyandi, D. (2021). The Effectiveness of Fertilizer Subsidy: How the Impact to the Production. *SOCA: Jurnal Sosial, Ekonomi Pertanian*, *15*(2), 345. https://doi.org/10.24843/soca.2021.v15.i02.p10

Aigner, D., Lovell, C. A. K., & Schmidt, P. (1977). Formulation And Estimation Of Stochastic Frontier Production Function Models. *Journal of Econometrics*, *6*, 21–37. https://doi.org/10.1016/j.jeconom.2023.01.023

Alnaass, N. S., Agil, H. K., & Ibrahim, H. K. (2021). Use of fertilizers or importance of fertilizers in agriculture. *International Journal of Advanced Academic Studies*, *3*(2), 52–57. www.allstudyjournal.com

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (3): 631 - 652, November 2025

Ashari, M. L., & Hariani, D. (2019). Analisis Efektivitas Program Kartu Tani di Kecamatan Banjarnegara Kabupaten Banjarnegara. *Journal of Public Policy and Management Review*, *8*(2), 1–21. https://ejournal3.undip.ac.id/index.php/jppmr/article/view/23711/21583

National Food Agency. (2023). *NFA Dorong BUMN Pangan Penuhi Stok Cadangan Jagung Pemerintah Sesuai Penugasan*.

Badan Penelitian dan Pengembangan Pertanian. (2020). *Rekomendasi pupuk N, P, dan K spesifik lokasi untuk tanaman padi, jagung dan kedelai pada lahan sawah (per kecamatan)*.

Barlog, P., Grzebisz, W., & Łukowiak, R. (2022). Fertilizers and Fertilization Strategies Mitigating Soil Factors Constraining Efficiency of Nitrogen in Plant Production. *Plants*, *11*(14). https://doi.org/10.3390/plants11141855

Bempomaa, B., & Acquah, H. de-G. (2014). Technical efficiency analysis of maize production: evidence from Ghana. *Applied Studies in Agribusiness and Commerce*, *8*(2–3), 73–79. https://doi.org/10.19041/apstract/2014/2-3/9

Bhatt, M. S., & Bhat, S. A. (2014). Technical Efficiency and Farm Size Productivity Micro Level Evidence from Jammu & Kashmir. *International Journal of Food and Agricultural Economics*, *2*(4), 27–49. file:///F:/Spec 2/Traffic Delay Model.pdf

Bibi, Z., Khan, D., & Haq, I. ul. (2021). Technical and environmental efficiency of agriculture sector in South Asia: a stochastic frontier analysis approach. *Environment, Development and Sustainability*, *23*(6), 9260–9279. https://doi.org/10.1007/s10668-020-01023-2

Bourenkov, G. P., & Popov, A. N. (2006). A quantitative approach to data-collection strategies. In *Acta Crystallographica Section D: Biological Crystallography* (Vol. 62, Issue 1). International Union of Crystallography. https://doi.org/10.1107/S0907444905033998

BPS Jawa Timur. (2018). *Produksi Jagung dan Kedelai di Provinsi Jawa Timur Menurut Kabupaten/Kota (ton)*.

Busthanul, N., Rukmana, D., Syafiuddin, M., & Mukmin. (2023). Effectivess of The Fertilizer Subsidy Policy. *Agrisocionomics : Jurnal Sosial Ekonomi Dan Kebijakan Pertanian*, *7*(1), 16–26. http://ejournal2.undip.ac.id/index.php/agrisocionomics

Đokić, D., Novaković, T., Tekić, D., Matkovski, B., Zekić, S., & Milić, D. (2022). Technical Efficiency of Agriculture in the European Union and Western Balkans: SFA Method. *Agriculture (Switzerland)*, *12*(12). https://doi.org/10.3390/agriculture12121992

Donald C. M. (1958). The Interaction of Competition for Light and for Nutrients. *Australian Journal of Agricultural Research*, *9*, 421–436.

Farjana, F., & Khatun, A. (2020). Technical Efficiency Assessment of Dairy Farm in the South-west Region of Bangladesh. *Global Journal of Human-Social Science*, *20*(1), 21–28. https://doi.org/10.34257/gjhssevol20is1pg21

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (3): 631 - 652, November 2025

Fauzan, M., Akhmadi, H., Thach, K. S. R., & Dwi Maulidiawati, N. (2023). Technical efficiency and corn farming productivity: A stochastic frontier analysis of small-scale farmer in Indonesia. *E3S Web of Conferences*, *444*, 1–9. https://doi.org/10.1051/e3sconf/202344402026

Fauziyah, E., Muhsoni, F. F., Hasanah, P. D., Noviandika, L., Fajrullah, A., & Purwanto, Z. (2022). Kebijakan Subsidi Pupuk : Prespektif Efisiensi & Daya Saing. In *GETPRESS INDONESIA*. https://www.republika.id/posts/14462/kebijakan-subsidi-pupuk

Gay, L. R., & Diehl, P. L. T. A.-T. T.-. (1992). *Research methods for business and management* (NV-1 o). Macmillan Pub. Co. ; Maxwell Macmillan Canada ; Maxwell Macmillan International. https://doi.org/LK - https://worldcat.org/title/1419851469

Gerber, A. (2016). Short-term success versus long-term failure: A simulation-based approach for understanding the potential of zambia's fertilizer subsidy program in enhancing maize availability. *Sustainability*, *8*(10). https://doi.org/10.3390/su8101036

Ghimire, B., Dhakal, S. C., Marahatta, S., & Bastakoti, R. C. (2023). Technical efficiency and its determinants on lentil (Lens culunaris) production in Nepal. *Farming System*, *1*(3), 100045. https://doi.org/10.1016/j.farsys.2023.100045

Ginting, T. T. M., Supriana, T., & Tafsin, M. (2023). *Production Efficiency Analysis Kub Chicken*. *7*(1).

Goffar, A., & Agustin, L. (2021). Management Of Facilities and Infrastructure in Improving Quality of Graduates. *International Journal of High Education Scientists (IJHES)*, *2*(2), 36–47. www.ijhes.com

Indrianingsih, R. S., Wulandari, E., & Karyani, T. (2023). Technical Efficiency of Horticultural Farming in Cianjur District. *Agrisocionomics : Jurnal Sosial Ekonomi Dan Kebijakan Pertanian*, *2*(April 2012), 173–183.

Jin, G., Yu, H., He, D., & Guo, B. (2024). Agricultural Production Efficiency and Ecological Transformation Efficiency in the Yangtze River Economic Belt. *Land*, *13*(1). https://doi.org/10.3390/land13010103

Junaedi, Afirin, Sumange, L., Arsyad Biba, M., & Zulkifli. (2023). Technical Efficiency and Production Factors of Rainfed Rice Farming. *Agrisocionomics : Jurnal Sosial Ekonomi Dan Kebijakan Pertanian*, *7*(2), 261. http://ejournal2.undip.ac.id/index.php/agrisocionomics

Kea, S., & Shahriar, S. (2023). Stochastic Frontier Analysis. *Encyclopedia of Tourism Management and Marketing*, *2022*, 251–254. https://doi.org/10.4337/9781800377486.stochastic.frontier.analysis

Ministry of Agriculture. (2014). Penyusunan Rencana Definitif Kebutuhan Kelompok tani (RDKK) Pupuk Bersubsidi. In *Direktoral Pupuk dan Pestisida*. https://psp.pertanian.go.id/storage/236/Pedoman-RDKK.pdf

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (3): 631 - 652, November 2025

Ministry of Agriculture. (2022). *Pedoman Teknis Pengelolaan Pupuk Bersubsidi Direktorat Pupuk Dan Pestisida Revisi II*. https://psp.pertanian.go.id/storage/1273/27.-Petunjuk-Teknis-Pengelolaan-Puber-TA-2022-REVISI-II_FINAL.pdf

Kholis, I., & Setiaji, K. (2020). Analisis Efektivitas Kebijakan Subsidi Pupuk Pada Petani Padi. *Economic Education Analysis Journal*, *9*(2), 503–515. https://doi.org/10.15294/eeaj.v9i2.39543

KSA Kabupaten Pamekasan. (2022). *Satu Data Pamekasan*. https://satudata.pamekasankab.go.id/storage/uploads/filesata_upload/file_sata_100115625.xlsx

Kune, S. J., Muhaimin, A. W., & Setiawan, B. (2016). Analisis Efisiensi Teknis dan Alokatif Usahatani Jagung (Studi Kasus di Desa Bitefa Kecamatan Miomafo Timur Kabupaten Timor Tengah Utara). *Agrimor*, *1*(01), 3–6. https://doi.org/10.32938/ag.v1i01.23

Kurnia, S. A., Ekowati, T., Handayani, M., Program, A. S., Sciences, A., & Java, C. (2024). Analysis Of Production Efficiency in Hybrid Corn Seed Farming In. *Agrisocionomics : Jurnal Sosial Ekonomi Dan Kebijakan Pertanian*, *8*(June), 350–362.

Lazuardi, F. H., Sukowati, P., & Widjajani, R. (2024). Use of Farmer Cards in the Distribution of Subsidized Fertilizer in Pasuruan Regency, Indonesia. *International Journal of Research in Social Science and Humanities*, *05*(04), 31–40. https://doi.org/10.47505/ijrss.2024.4.3

Liu, Q., Sun, X., Wu, W., Liu, Z., Fang, G., & Yang, P. (2022). Agroecosystem services: A review of concepts, indicators, assessment methods and future research perspectives. *Ecological Indicators*, *142*(June), 109218. https://doi.org/10.1016/j.ecolind.2022.109218

Marhaeni, Gunarto, T., & YT, A. R. (2024). The Effectiveness of Subsidized Fertilizer Distribution to Farmers in North Lampung District. *International Journal of Economics, Business, and Entrepreneurship*, *7*(1), 24–42.

Ndubueze-ogaraku, M. E., & Graves, A. (2012). *Measuring Farm Technical Efficiency using Stochastic Frontier Production Function Model Approach*. *Fao*.

Okello, D. M., Bonabana-Wabbi, J., & Mugonola, B. (2019). Farm level allocative efficiency of rice production in Gulu and Amuru districts, Northern Uganda. *Agricultural and Food Economics*, *7*(1), 0–19. https://doi.org/10.1186/s40100-019-0140-x

Ortiz, D., & Leal, V. (2020). Energy policy concerns, objectives and indicators: A review towards a framework for effectiveness assessment. *Energies*, *13*(24). https://doi.org/10.3390/en13246533

Paudel, J., & Crago, C. L. (2017). Fertilizer Subsidy and Agricultural Productivity: Empirical Evidence from Nepal Jayash. *AgEcon Search*, 18. file:///F:/Spec 2/Traffic Delay Model.pdf

Prasetyo, D. D., & Fauziyah, E. (2020). Efisiensi Ekonomi Usahatani Jagung Lokal Di Pulau Madura.

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (3): 631 - 652, November 2025

Agriscience, *1*(1), 26–38. https://doi.org/10.21107/agriscience.v1i1.7505

Pratama, A. F. A. (2023). Analisis Evaluasi Kebijakan PERMENTAN No. 10 Tahun 2022 di Kampung Kotagajah Kecamatan Kota Gajah Kabupaten Lampung Tengah. *Jurnal Socia Logical*, *3*(1), 1–8.

Rahmaniyah, F., & Rum, M. (2020). Analisis Daya Saing Jagung Hibrida Unggul Madura Mh-3 Di Kabupaten Bangkalan. *Agriscience*, *1*(2), 367–382. https://doi.org/10.21107/agriscience.v1i2.8020

Rigi, N., Raessi, S., & Azhari, R. (2019). Analisis Efektivitas Kebijakan Pupuk Bersubsidi Bagi Petani Padi Di Nagari Cupak Kecamatan Gunung Talang Kabupaten Solok. *JOSETA: Journal of Socio-Economics on Tropical Agriculture*, *1*(3), 75–83. https://doi.org/10.25077/joseta.v1i3.184

Rizal, R., & Togimin, T. (2023). Assistance in Preparing E-RDKK at Gapoktan "Rejo Mulyo" in Rejoagung Village, Sumberwringin District, Bondowoso Regency. *Journal of Community Services and Engagement: Voice of Community (VOC)*, *3*(3), 22–29. https://doi.org/10.23917/voc.v3i3.5308

Selorm, A., Sarpong, D. B. S., Egyir, I. S., Mensah Bonsu, A., & An, H. (2023). Does contract farming affect technical efficiency? Evidence from soybean farmers in Northern Ghana. *Agricultural and Food Economics*, *11*(1). https://doi.org/10.1186/s40100-022-00240-9

Sumane, S., Kunda, I., Knickel, K., Strauss, A., Tisenkopfs, T., Rios, I. des I., Rivera, M., Chebach, T., & Ashkenazy, A. (2018). Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture. *Journal of Rural Studies*, *59*, 232–241. https://doi.org/10.1016/j.jrurstud.2017.01.020

Taherdoost, H. (2016). Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. *International Journal of Academic Research in Management (IJARM)*, *5*(2), 18–27.

Takeshima, H., & L. Tasie, L. S. O. (2015). Fertilizer subsidies, political influence and local food prices in sub-Saharan Africa: Evidence from Nigeria. *Food Policy*, *54*, 11–24. https://doi.org/10.1016/j.foodpol.2015.04.003

Tumuri, A., Geleta, D., & Sime, G. (2024). Technical efficiency of maize production and their determinants among smallholder farmers in Ethiopia: a case study in Sidama Region. *Cogent Food and Agriculture*, *10*(1). https://doi.org/10.1080/23311932.2024.2392045

Vejan, P., Khadiran, T., Abdullah, R., & Ahmad, N. (2021). Controlled release fertilizer: A review on developments, applications and potential in agriculture. *Journal of Controlled Release*, *339*(October), 321–334. https://doi.org/10.1016/j.jconrel.2021.10.003

Wang, J., & Hu, X. (2021). Research on corn production efficiency and influencing factors of typical farms: Based on data from 12 corn-producing countries from 2012 to 2019. *PLoS ONE*, *16*(7

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (3): 631 - 652, November 2025

July), 1–17. https://doi.org/10.1371/journal.pone.0254423

Warr, P., & Yusuf, A. A. (2014). Fertilizer subsidies and food self-sufficiency in Indonesia. *Agricultural Economics*, *45*(5), 571–588. https://doi.org/10.1111/agec.12107

Wulandari, V. (2024). *Analisis Efektivitas Distribusi Pupuk Bersubsidi Pada Tingkat Petani Padi di Nagari Silongo Kecamatan Lubuk Tarok Kabupaten Sijunjung*. Universitas Andalas.

Yusli, Y., & Fauziyah, E. (2020). Variabel Penentu Dan Efisiensi Teknis Produksi Jagung Lokal Di Madura. *Agriscience*, *1*(1), 61–73. https://doi.org/10.21107/agriscience.v1i1.7591