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The Impact of Fertilizer Subsidy Policies on The Profits and Welfare of Rice Farmers: Lessons from Sumbawa West District

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Abstract: The objectives of this study were to analyze the impact of fertilizer subsidy policies on production, profits, and surplus of rice farmers, and to compare productivity, profits, and surplus of rice farmers. The study was conducted in Brang Rea District, West Sumbawa Regency. The respondents in this study were farmers who owned rice farmers with details of 30 farmers who received fertilizer subsidies and 30 farmers who did not receive fertilizer subsidies. Data were collected through observation, surveys, and in-depth interviews. Data were analyzed using the optimization of the Cobb-Douglas production and profit functions. The results of the study concluded that the impact of fertilizer subsidy policies on production was positive and significant, while the impact on profits was positive but not significant. There was a significant difference between productivity and capital costs or production facility costs between the group of farmers who received fertilizer subsidies and the group of farmers who did not receive fertilizer subsidies, but there was a difference in labor costs and profits but not significant. The level of farmer welfare in the group of farmers who received subsidies was higher than the group of farmers who did not receive subsidies.

Keywords: Fertilizers; Producer surplus; Rice; Subsidies

Introduction

Rice (paddy) for the Indonesian people, including the people of West Nusa Tenggara, is a staple food that must be available throughout the year. Li et al. (2024), Qadir et al. (2024), Maertens & Velde (2017), and Rozi et al. (2023) said that not only for Indonesia, rice is also the most important staple food for the world's population and rice is the main source of carbohydrates for almost half of the world's population.

Technology in agriculture was created to make it easier for farmers to manage their farms, as well as to increase agricultural production and improve the well-being of farming communities. This technology will continue to develop and be dynamic in the future. The latest technology that has brought agriculture forward is the use of production inputs such as the use of fertilizers. Historically, the use of fertilizers for planting media has started since farmers began to plant crops in their fields, in other words, the use of fertilizers among farmers has become a culture that is integrated with agricultural activities. Likewise, Munanto (2021) said that in Indonesia, organic fertilizers have been known for a long time by farmers. The Indonesian population was familiar with organic fertilizers before the implementation of the green revolution in Indonesia. After the green revolution, most farmers prefer to use artificial fertilizers because they are convenient to use, the quantity is much less than organic fertilizers, the price is relatively cheap, and easy to obtain.

Rice production can be increased through optimal use of production factors such as land, seed, fertilizer, and labor. This means that all of these production factors play an important role in increasing rice production. For farmers who join farmer groups, it will be easier to get

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quality seeds and the fertilizers they need. In line with this, according to Shen et al. (2024), Lan et al. (2024), and Asadu et al. (2024) that the production factors of labor, fertilizer, water, have an important role in rice production and are useful as nutrients for rice plants. Even Salam et al. (2021) stated that the fertilizer production factor is an important factor in sustainable agricultural development. The results of research by Salam et al. (2024) stated that production factors such as land area, seeds, fertilizer and labor have a significant effect on production. This means how important the production factors are in producing rice plants.

Most farmers are already very dependent on artificial fertilizers, which can have a negative impact on the development of agricultural production. The growing awareness of farmers about the negative impacts of the use of artificial fertilizers and other modern agricultural facilities on the environment has made them switch from conventional farming to organic farming. Likewise, Utami (2021) stated that the growing awareness of farmers about the negative impacts of the use of artificial fertilizers and other modern agricultural facilities on the environment has made them switch from conventional farming to organic farming. The positive impacts of using chemical fertilizers are: fertilizing the soil. Making plants grow faster and healthier and also avoiding pests and diseases. Wang et al. (2024) stated that chemical fertilizers have a direct effect on rice production and are the main factor contributing to soil nutrition.

Murnita & Taher (2021) stated that the combination of organic and inorganic fertilizers can improve soil chemical properties and produce rice production of up to 8.05 tons per hectare. The results of Padmanabha et al. (2014) stated that there was a significant interaction in the combination of organic and inorganic fertilizers on the maximum plant height variable, the highest value of 117 cm was 9.34% higher than the control. The use of organic fertilizers can increase Nitrogen levels in the soil. The use of inorganic fertilizers can increase Potassium levels in the soil. The combination of urea 250 kg/ha, SP36 75 kg/ha, and KCl 75 kg/ha, can increase the maximum number of tillers, the number of productive tillers, the weight of dry harvested and oven-dry grain. Misran (2014) stated that the combination of inorganic fertilizers (urea + SP36 + KCl) can increase dry harvested grain production to 6.13 tons/ha or 38.69% compared to without using inorganic fertilizers. The results of the study by Kurniawan et al. (2017) stated that plant height, number of tillers, dry harvested grain yield and dry milled grain yield in the SRI (system of rice intensification) method were significantly higher than the conventional method. Chemical fertilizer doses can be reduced and replaced with organic fertilizers.

The policy of subsidizing inorganic fertilizers, especially urea fertilizers, is gradually being reduced in number and replaced with organic fertilizers and this has been going on in the West Sumbawa Regency area of West Nusa Tenggara Province. Organic fertilizers are very beneficial for increasing agricultural production both in quality and quantity, reducing environmental pollution, and improving land quality sustainably. The use of organic fertilizers in the long term can increase land productivity and prevent land degradation. Several researchers such as Munanto (2021) stated the same thing, namely that the benefits of organic fertilizers are quite good.

On the other hand, the decrease in the amount of fertilizer subsidies will have an impact on the decrease in rice production and the income and welfare of farmers. Here, farmers think rationally that the decrease in the amount of fertilizer use will have consequences for the increase in the amount of fertilizer shortages by buying on the free market. Thus, farmers will incur additional production costs. The results of research by Defita & Adnan (2023) and Anisa & Adnan (2021) stated that the distribution of subsidized fertilizers was not yet effective because it did not meet the criteria for the right amount, price, and time. The distribution of fertilizers that was still not on target and ineffective caused an increase in production costs because some farmers did not get the fertilizer according to their quota.

The problem now is whether the fertilizer subsidy policy can still provide increased rice production, profits and welfare for farmers. This is very dependent on the extent to which farmers decide to use urea and NPK fertilizers in maintaining the rice production that has been carried out. Therefore, it is very interesting to conduct a study on the impact of the fertilizer subsidy policy on the production, profits, and welfare of farmers in lowland rice farming in West Sumbawa Regency. The objectives of this study are: to analyze the impact of the urea fertilizer subsidy policy on the production, profits, and welfare of lowland rice farming, to compare the productivity, profits and welfare of farmers.

Method

Data Collection and Sampling Area

Data collection for this study using observation, survey and in-depth interview methods. The observations were made by direct observation at the location of the farm and where the farmer lives (Saha et al., 2022). The survey was carried out by interviewing rice farmers using a list of questions, while in-depth interviews were conducted to verify the data with their cultivation documents or records. The research was carried out in West Sumbawa Regency with Sapugara

Bre village, Brang Rea district as the research site, keeping in mind that there were a number of farmers who received fertilizer subsidies and did not receive fertilizer subsidies.

Unit of Analysis

The location selection was based on farmers who received fertilizer subsidies and did not receive fertilizer subsidies of the area and the result of previous research (Figure 1).

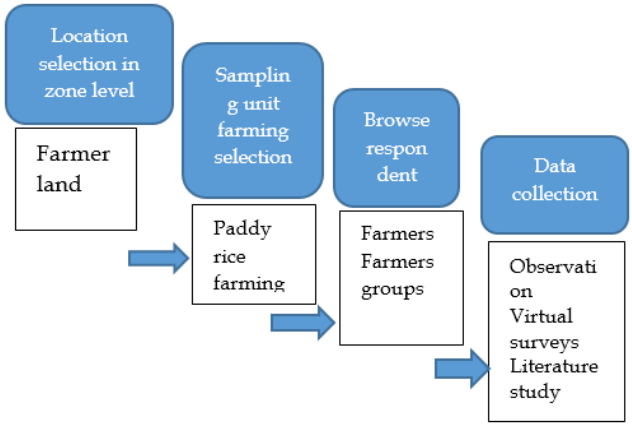

Figure 1. Stage of the research

The unit of analysis is the rice crop owned by the farmers who were selected as respondents.

Respondent Sampling

Respondents in this study were farmers who owned paddy rice crops. The determination of the number of respondents was carried out by quota sampling (Futri et al., 2022) with a total of 60 respondents with details of each of the 30 respondents for farmers who received fertilizer subsidies and 30 respondents for farmers who did not receive fertilizer subsidies.

Procedure for the Data Analysis

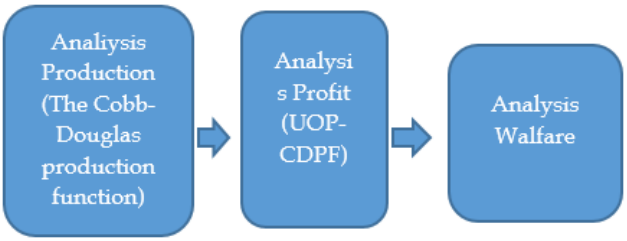

Figure 2. The stage of the producer's surplus (Walfare)

Measuring the welfare of rice farmer households through producer surplus (welfare) starts from measuring production using the Cobb-Douglas production function (Solow, 1956; Brahimi, 2022; DeCanio, 2016). Then measure the profit of rice farming through the Unit Output Price Cobb-Douglas Profit Function (UOP-CDPF) technique. Lastly measure the welfare of producers through the measurement of producer surplus which is derived from the profit function (Figure 2).

Variables and Data Analysis

The data collected from the survey was then edited, tabulated, and analyzed. The analysis model used is: Cobb-Douglas production and benefit functions. Sadoulet & Janvry (1995) and Suharyanto et al. (2015) state that the profit function can be derived using the Cobb-Douglas Unit Price Profit Function (UOP-CDPF) technique, assuming that producers maximize their profit satisfaction UOP-CDPF is a function that includes production and factors of production normalized at prices of production.

Cobb-Douglas production function with 4 independent variables, namely seed costs, fertilizer costs, labor costs, and the altitude dummy.

$$q = \alpha X^{\beta} Z^{\Upsilon} \quad (1)$$

q = quantity of output
X = quantity of variable input
Z = quantity of fixed input
α = intercept (constant)
β and ϒ = output elasticity of input X and Z

The empirical model of the Cobb-Douglas Production Function in this analysis is shows in the following equation (Rahnanita & Syamsyah, 2018):

$$qi = \alpha Xi^{\beta} Zi^{\Upsilon} Di^{\phi} \quad (2)$$

To facilitate the estimation of equation (2) and data in the distribution of production and determination of the normal distribution, the equation is transformed to a linear form by making it with logarithms, then the equation becomes:

$$\ln qi = \ln \alpha + \beta \ln Xi + \Upsilon \ln Zi + \phi Di + \varepsilon i \quad (3)$$

qi = rice production (kg)
α = constant
Xi = cost of production factors (seeds, fertilizers, labor) (IDR)
Zi = fixed costs (IDR)
Di = 1 for subsidized farmers
Di = 0 for farmers who do not receive subsidies
Receive Function:

$$R = p^*q$$

$$R = p^*\alpha X^{\beta} Z^{\Upsilon} \quad (4)$$

Cost Function:

$$C(q) = vZ + wX \quad (5)$$

v = capital income for fixed input
w = price of variable input
Profit Function:

The level of business profit is the company's ability to generate profits (Novi, 2023; Nyakwawa et al., 2022). So, to measure the profit of farming, can use the formula:

$$\pi(X,Z) = p.q - C(q) = P.f(X,Z) - (\omega X) \quad (6)$$

π = profit
p = exit price per unit

If ω = ω/p means the normalized price of the input variable, then equation (6) can be normalized with the exit price so that the exit price profit (Profit UOP) becomes:

$$\pi/p(X,Z) = p.q - C(q) = p.f(X,Z) - (\omega/p.X) \quad (7)$$

The main requirement to maximize profit is that the first derivative of the profit function is equal to zero:

$$\pi = P\alpha X^{\beta} Z^{\gamma} - \omega X$$
$$\partial\pi/\partial X = \beta P\alpha X^{\beta-1} Z^{\gamma} - \omega = 0 \quad (8)$$
$$\beta P\alpha X^{\beta-1} Z^{\gamma} = \omega \quad (9)$$
$$X^{\beta-1} = [\omega / \beta P\alpha Z^{\gamma}] \quad (10)$$
$$X^* = [\omega / \beta P\alpha Z^{\gamma}]^{1/\beta-1} \quad (11)$$

Equation (11) indicates that the amount of input needed to obtain the maximum profit depends on the price of the product, the price of the input and the fixed input. Substituting equations 11 and 1, the optimal output will be obtained as follows:

$$q = \alpha X^{\beta} Z^{\gamma}$$
$$q = \alpha[(\beta\alpha Z^{\gamma} P/\omega)^{1/\beta-1}]^{\beta} Z^{\gamma}$$
$$q = \alpha[(\alpha Z^{\gamma})^{1/\beta-1} (\beta.P/\omega)^{\beta/1-/\beta} Z^{\gamma/1-\beta}]$$
$$q = \alpha^{1/\beta-1}[(\beta.P/\omega)^{\beta/1-/\beta} Z^{\gamma/1-\beta}] \quad (12)$$

Equation (12) shows that the optimal quantity of products produced to achieve maximum profit depends on the prices of the products, the prices of the inputs and the fixed costs Z. It is formulated as:

$$X^* = X^*(p,\omega,Z) \quad (13)$$

Substituting equations (11) and (12) into the profit function, the maximum profit becomes:

$$\pi^* = P[\alpha^{1/1-\beta}[(\beta.P/\omega)^{\beta/1-/\beta}.Z^{\gamma/1-\beta}] - \omega[\alpha\beta Z^{\gamma}.P/\omega]^{1/1-\beta}$$
$$= P[\alpha^{1/1-\beta}\beta^{\beta/1-/\beta}.(P/\omega)^{\beta/1-/\beta} Z^{\gamma/1-\beta}] - \omega[\alpha^{1/1-\beta} \beta^{1/1-\beta} Z^{\gamma/1-\beta}.(P/\omega)^{1/1-\beta}]$$
$$= \alpha^{1/1-\beta} \beta^{\beta/1-/\beta}.(1-\alpha).Z^{\gamma/1-\beta}.P^{1/1-\beta}.\omega^{-\beta/1-/\beta}) \quad (14)$$

Equation 14 shows that the maximum profit (π*) received by farmers depends on the price of the product (p), the price of the inputs (v) and the fixed inputs (Z) The empirical model used in the profit analysis of the rice crop is the Cobb-Douglas profit function model with the following equation:

$$\pi i = \lambda V^{\alpha} \omega^{\beta} Z^{\gamma} Di^{\phi} \quad (15)$$

To estimate equation (15) and the data on the distribution of profits and determine which is close to the normal distribution, the equation is transformed into logarithmic form:

$$\ln \pi i = \ln \lambda + \alpha \ln v + \beta \ln \omega + \Upsilon \ln Z + \phi Di + \varepsilon i \quad (16)$$

πi = Normalized profit of rice farmers (IDR)
ƛ = profit function line
v = rice crop productivity (kg/ha)
ω = cost of capital (IDR/ha)
Z = cost of labor (IDR/ha)
Di = 1 for farmers receiving subsidies
Di = 0 for farmers who do not receive subsidies

Producer surplus is the difference between the prices of goods that producers can sell and the prices that producers can accept for the quantity of goods sold. Producer surplus also means the ability of producers to earn income from goods sold at a foregone cost. Mathematically, the grain supply equation is realized through the Total Cost equation. Generally, the cost function used is a cubed function, so the equation is as follows:

$$TC = C + \beta_1 Q^1 + \beta_2 Q^2 + \beta_3 Q^3 \quad (17)$$
$$MC = \beta_1 + 2\beta_2 Q^1 + 3\beta_3 Q^2 \quad (18)$$

Information:
TC = Total cost (IDR)
MC = Marginal cost (IDR)
C = constant
Q = quantity of grain production (kg)

Because marginal cost is equal to supply, the supply equation is the same as equation (18). The maximum profit is achieved when the price (P) is equal to the marginal cost (P = MC). To maximize the profit of rice farming, the requirement is that the price of rice must be greater than the average cost of rice farming and the marginal cost is the same as the price of rice (Syaiful et al., 2022).

To calculate the amount of producer surplus (Walfare), the following equation will be used:

$$PS = \delta TR - \delta TC \quad (19)$$
$$PS = MR - CM$$
$$PS = \tfrac{1}{2} \int(MR-MC)$$
$$PS = \tfrac{1}{2} \int(P - MC) \quad (20)$$

Information:
PS = producer surplus (IDR)
TR = P * Q = total revenue
TC = total cost
MR = marginal revenue = P
P = equilibrium price or market price of grain (IDR/kg)
MC = marginal cost

Result and Discussion

Estimated Production of Rice Cultivation

The production of rice in West Sumbawa Regency is highly dependent on the number of factors of production that are used. In this study, the production factors used to produce lowland rice included rice seeds,

fertilizers, pesticides, and labor. To facilitate the calculation, the factors of production are grouped into capital costs (production inputs) and labor costs. Table 1. Explain that the results of the analysis show that all the factors of capital costs, labor costs and fertilizer subsidy policies have a significant effect on production. The magnitude of this influence can be explained from the magnitude of the determination coefficient, which is 0.958, which means 95.80% of the influence of variable costs of production facilities, labor costs and subsidy policies on the variable. rice production. The research results of Suharyanto et al. (2015) and Zakirin et al. (2013) stated that the factors of rice seeds, urea fertilizer and labor had a significant effect on rice production in Bali and Pontianak.

The partial statistical test can be explained (Table 1) that the regression coefficient of the capital cost factor is 0.595, which means that capital costs have a significant effect on rice production, where each additional 1% of cost of capital will increase rice production by 0.595%. Because the regression coefficient of the capital cost factor is less than 1 (one), rice production still has the opportunity to increase by increasing the acquisition costs of factors of production, such as seeds and fertilizers. Next is the labor cost production factor, the regression coefficient is 0.333, which means that the labor cost production factor has a significant effect on rice production, where every 1% increase in labor cost of production will increase production by 0.333%. There are still opportunities for farmers to increase rice production at additional labor costs. The research results of Cañete & Temanel (2017), Muhardi & Effendy (2021), and Wilujeng & Fauziah (2021) state that rice seed costs, fertilizer costs and labor costs have a significant effect and have a positive contribution to irrigated rice production. land in the Isabela Province of the Philippines, in Central Sulawesi and Lamongan District. As for the fertilizer subsidy policy factor, it turns out that it also has a significant effect on lowland rice production. The regression coefficient shows a value of 0.125 and is positive. This means that the fertilizer subsidy policy has a significant effect on rice production, where with the subsidy policy, rice production is 0.125% higher than without fertilizer subsidies. This shows that the policy of giving fertilizer subsidies to farmers has a positive impact on rice production.

Table 1. Results of regression analysis of factors affecting lowland rice production in West Sumbawa Regency in 2022

Variable	Coefficients Regression	Standard Error	t	Significant
Constant	-10.70	0.43	-24.88	0.00
Ln cost of capital	0.59	0.14	3.98	0.00
Ln cost of labor	0.33	0.16	1.98	0.05
Dummy subsidy	0.12	0.06	2.03	0.04

Source: primary data processed
Independent variable: Production
R^2 (coefficient determination) = 95.80

Estimated Profit of Rice Cultivation

In economic theory it is stated that the profit of rice cultivation depends on the income and production costs of the crop. The results showed that the profits of lowland rice cultivation with fertilizer subsidies were higher than those without subsidies (Table 2). The big difference is 8.58%, but the profit difference is not significant, because the profit difference is relatively small. This is because the incomes of farmers who receive subsidies are relatively lower than those of farmers who do not receive subsidies. The difference in income per hectare is 18.43%, in addition to the fact that the productivity of grain yields obtained by farmers who receive subsidies is also relatively lower while the difference in productivity is 13.11%. However, the price of grain received by the two groups of farmers is the same, namely IDR 3,500/kg.

The most striking difference is in the cost of production facilities. The group of farmers receiving subsidies incur relatively lower production input costs than the group of farmers not receiving subsidies, and the difference is significant. The difference in the cost of production facilities is 81.43%. Therefore, the striking difference between income and production costs causes relatively low profits for rice cultivation, because the difference is around IDR 500,000 per hectare.

Table 2. Differences in the profits of rice farming in West Sumbawa Regency 2022

Description	Rice Farmers		t-Statistic	p-value
	Subsidy	No Subsidy		
Profit (IDR/ha)	6,059,224.47	5,580,023.44	-0.57	0.56
Revenue (IDR/ha)	17,538,109.16	20,771,073.17	-2.62	0.01
Productivity (kg/ha)	5,010.90	5,667.93	-2.57	0.01
Cost of Capital (IDR/ha)	4,417,623.48	8,015,078.63	-13.16	0.00
Cost of Labor (IDR/ha)	4,721,015.59	5,103,264.01	-1.35	0.18

Source: primary data processed

The difference in labor costs between the two groups was not significant and the difference was not significant. The difference is 8.09%. This relatively small

difference does not have much impact on the profits earned by farmers. This can be seen in Table 2. Statistically, the labor cost factor does not have a significant effect on the profits of rice farmers. This means that, collectively, labor costs incurred by groups of farmers who receive subsidies and those who do not receive subsidies do not contribute to the profits made.

Impact of Fertilizer Subsidy Policy on Profits from Lowland Rice Cultivation

To test the hypothesis of the impact of the fertilizer subsidy policy on the profits of rice cultivation, a statistical test of the profit function was carried out for groups of farmers who received fertilizer subsidies and groups of farmers who did not receive subsidies. of fertilizers, as well as a combination of the two. The test of the effect of productivity variables, capital costs and labor costs on earnings is carried out using the Cobb-Douglas earnings function regression model summarized in Table 3.

Table 3. Estimated profit of rice farming

Explanatory Variable	Profit of Rice Farmers		
	Subsidy	No Subsidy	Combination
Intercept	64.04	39.92	10.72
	(6.88)*	(11.66)*	(4.22)**
Productivity (ln X1)	.81	2.89	2.99
	(.44)***	(1.17)**	(.32)*
Cost of Capital (ln X2)	-1.76	.16	-.86
	(.62)*	(1.17)	(.40)**
Cost of Labor (ln X3)	-2.39	-3.93	-.48
	(.47)*	(1.09)*	(.32)
Dummy of Subsidy	-	-	-.00
			(.23)
Adjusted R^2	0.75	0.41	0.68
F	30.27*	7.91*	33.65*
Number of Observation	30	30	60

Source: primary data processed
***) significant at 1% error level
**) significant at 5% error level
*) significant at 10% error rate

The results of the simultaneous statistical tests (Table 3) show that all the independent variables, such as productivity, production facility costs, labor costs, and dummy subsidies, together significantly influence profits from rice cultivation. Judging by the value of the determination coefficient (R^2), it also shows a fairly large value, where the determination coefficient for the group of farmers who receive subsidies is 0.752, that is, 75.20% of the variation in profits. It is explained by productivity, production input costs and labor costs. While for the group of farmers who did not receive fertilizer subsidies, the value of the coefficient of determination was 0.417. It means only 41.70% of the effect of productivity, capital costs and labor costs on the profit of rice cultivation. For the subsidy policy variables together with productivity, production facility costs, and labor costs, the effect is 68.90% on profits from rice cultivation. The results of research by Mauki et al. (2023) stated that the gross margin of small-scale rice farmers is greatly influenced by changes in total variable costs, output prices, and productivity. Therefore, local governments and stakeholders must encourage increased rice farming profits.

The results of the partial statistical tests show (Table 3) that all the productivity variables, production input costs and labor costs have a significant effect on the profits of rice cultivation. For the productivity variable, the group of farmers receiving fertilizer subsidies has a significant effect on the profits from growing rice. This means that every 1% increase in productivity will increase profits by 0.813%. In the group of farmers who do not receive subsidies, productivity has a significant effect on profits from growing rice. This means that every 1% increase in productivity will increase profits by 2.89%. Meanwhile, the combination of the two groups of farmers shows that productivity has a significant effect on the profits from growing rice. Where every 1% increase in productivity will increase profits by 2.99%. The role of productivity in achieving the profit of the rice crop is very large, because seen from the value of the regression coefficient all the values are greater than 1 (one), this means that it is very sensitive. According to the research results of Arimbawa & Widanta (2017) and Andrias et al. (2017) who stated that the productivity factor had a real and positive effect on the income of farmers in Mengwi district, Bali province. and Barebeg Ciamis district, West Java province. Therefore, it is necessary to continuously improve the increase in productivity of rice plants, namely by using superior quality seeds, using balanced fertilizers, harvested area, and sufficient irrigation water.

For the variable cost of production facilities, in the group of farmers who receive the subsidy costs of production facilities, it has a significant effect on the profits of rice cultivation, where for every 1% increase in production costs production inputs, profits will decrease by 1.76%. While the combination of the two groups of farmers shows that the costs of production inputs have a significant effect on agricultural profits. Where each increase in the cost of production facilities by 1% will reduce the profit of growing rice by 0.86%. According to the results of the research by Ngango (2022), which establishes that the capital cost factor has a significant effect on the income of rice cultivation in Rwanda. The research results of Alfrida & Noor (2017) indicate that

the cost of capital or production facilities has a significant effect on the income of rice farmers in Gowa Regency, Indonesia.

For the labor cost variable, in the groups of farmers that receive subsidies, labor costs have a significant effect on profits, where each 1% increase in labor costs will reduce profits by 2.39%. In the group of farmers who did not receive subsidies, labor costs also had a significant effect on profits from growing rice. Where every 1% increase in labor costs will reduce profits by 3.93%. Combining the two groups of farmers shows that labor costs of 1% will reduce profits by 0.48%. The results of Ngango (2022) research indicate that the labor cost factor has a significant effect on income from rice cultivation in Rwanda.

The fertilizer subsidy policy can be seen in the combination of the two groups of farmers, where the fertilizer subsidy policy does not have a significant effect on the profits of rice cultivation. However, viewed from magnitude and direction, it shows a negative direction. This means that the fertilizer subsidy policy is not encouraging enough to increase profits from rice cultivation.

Analysis of Producer Surplus

Producer surplus is a measure to assess the welfare level of farmers. The amount of producer surplus is largely determined by the price of grain received by farmers, the productivity of rice, and the costs farmers sacrifice in a planting season. The productivity of land producing rice for the group of farmers receiving fertilizer subsidies is lower than for the group of farmers not receiving fertilizer subsidies (Table 4). Even so, farmers who receive subsidies have a lower break-even point than farmers who do not receive subsidies. This means that subsidized farmer groups are even better able to repay their capital. Also, because the difference between productivity and the break-even point of production is greater (80%) for the group of subsidized farmers compared to the group of non-subsidized farmers of only 42%. This means that by producing 2.56 tons of rice per hectare, farmers in the subsidy group can already cover all production costs. Unlike farmer groups without subsidies, they can only cover production costs when the rice produced is 3.68 tons per hectare. Meanwhile, the price of rice received by farmers from sales was the same in both groups, namely IDR 3,500 per kilogram.

Table 4. Walfare of rice farmers in West Sumbawa Regency in 2022

Items	Rice Farmers		Combination
	Subsidy	No Subsidy	
Paddy Price (IDR/kg)	3,500	3,500	3,500
Break Even Point Production (kg/ha)	2,567	3,682	4,408
Productivity (Kg/Ha)	4,617	5,234	7,234
Walfare (IDR/ha)	4,978,274	3,852,503	7,448,211

Source: primary data processed

The ability of farmers to achieve maximum production results with the minimum cost sacrifice is the most important objective for every crop carried out by farmers. The measure of agriculture's success in achieving these goals can be seen from the break-even point. The factors that determine the break-even quantity are grain prices, production costs, and income. In the group of farmers who receive subsidies, the production costs of growing rice are still lower than those of the group of farmers who do not receive fertilizer subsidies (Table 2). Meanwhile, the income from rice cultivation was higher for the group of farmers who did not receive subsidies than for the group of farmers who received subsidies. However, because the marginal income of the group of farmers who received the subsidy was relatively higher (89.89%) than the group of farmers who did not receive the subsidy (52.13%), the profit obtained was higher for the group of farmers who received the subsidy. grant. So, it can be understood that socioeconomically, farmers who receive subsidies have better capacities than groups of farmers who do not receive subsidies. This means that farmers already have the social and economic capacity to obtain benefits and well-being. In line with the results of the research of Alfrida & Noor (2017) who stated that the level of well-being of farmers in narrow, medium and large plots has reached a high level of well-being in terms of socioeconomic indicators.

The producer surplus achieved by the two groups of farmers illustrates the level of welfare of farmers. Judging from the producer surplus, it means that the group of farmers who receive subsidies have a higher level of welfare compared to the group of farmers without subsidies. The welfare obtained at this time is also inseparable from the role of the government in building a sustainable agricultural system. Some of the policies that play a role here include the policy of subsidizing fertilizer prices, increasing the purchase price of grain from farmers, increasing the rice planting area, and increasing irrigation areas. In addition to that, from the side of the farmers themselves they also have a

role in improving their well-being, for example, how to manage agriculture properly from rice seed preparation, planting maintenance, proper fertilization and harvest management. According to the research results of Sulistiyawati et al. (2021), he stated that the capacity of the farmers affects the well-being of the farmers, that is, on the skills of the farmers themselves, such as cultivation techniques from sowing, planting, seeding, weeding, fertilizing to managing plant pests. Mulwanyi et al. (2011) also said that a combination of government policies through policies to increase irrigation areas, increase grain purchase price from farmers, increase rice planting area, and decrease the price of fertilizer from urea, led to a higher producer surplus. The research results of Putri & Noor (2018) also indicated that the general or average level of well-being of households growing paddy rice in the narrow, medium and wide land strata in Sindangsari village fell into the category of high level welfare and the results of Pratama et al. (2021) affirmed that rice farmers in Kerinci Regency are classified as neither poor nor prosperous with a per capita income per planting season of IDR 5,053,227.

Conclusion

The results of the study concluded that the impact of fertilizer subsidy policies on production was positive and significant, while the impact on profits was positive but not significant. There was a significant difference between productivity and capital costs or production facility costs between the group of farmers who received fertilizer subsidies and the group of farmers who did not receive fertilizer subsidies, but there was a difference in labor costs and profits but not significant. The level of farmer welfare in the group of farmers who received subsidies was higher than the group of farmers who did not receive subsidies.

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The authors declare no conflict of interest.

References

Alfrida, A., & Noor, T. I. (2017). Analysis of Income and Welfare Level of Rice Farmers Based on Land Area. *Agroinfo Galuh*, *4*(3), 426-433. http://dx.doi.org/10.25157/jimag.v3i3.801

Andrias, A. A., Darusman, A., & Ramdan, M. (2017). The Effect of Land Area on Production and Income from Lowland Rice Farming (A Case in Jelat Village, Baregbeg District, Ciamis Regency. *Agroinfo Galuh*, *4*(1), 521-529. http://dx.doi.org/10.25157/jimag.v4i1.1591

Anisa, F., & Adnan, M. F. (2021). Evaluation of the Subsidized Fertilizer Distribution Program Through Farmer Cards in Padang Sago District, Padang Pariaman Regency. *JISIP (Jurnal Ilmu Sosial dan Pendidikan)*, *5*(4), 1137-1150. http://dx.doi.org/10.58258/jisip.v5i4.2496

Arimbawa, P. D., & Widanta, A. A. B. P. (2017). The Influence of Land Area, Technology and Training on Income of Rice Farmers with Productivity as Intervening Variable in Mengwi District. *E-Journal of Development Economics, Udayana University*, *6*(8), 1601-1627. Retrieved from https://ojs.unud.ac.id/index.php/eep/article/view/32402

Asadu, C. O., Ezema, C. A., Ekwueme, B. N., Onu, C. E., Onoh, I. M., Adejoh, T., Ezeorba, T. P. C., Ogbonna, C. C., Otuh, P. I., Okoye, J. O., & Emmanuel, U. O. (2024). Enhanced Efficiency Fertilizers: Overview of Production Methods, Materials Used, Nutrients Release Mechanisms, Benefits and Considerations. *Environmental Pollution and Management*, *1*, 32-48. https://doi.org/10.1016/j.epm.2024.07.002

Brahimi, F. (2022). The Role of Foreign Direct Investments in the Economic Development of Albania. *IFAC-PapersOnLine*, *55*(39), 399-403. https://doi.org/10.1016/j.ifacol.2022.12.064

Cañete, D. C., & Temanel, B. E. (2017). Factors Influencing Productivity and Technical Efficiency of Rice Farmers in Isabela, Philippines. *Journal of Advanced Agricultural Technologies*, *4*(2), 111–122. https://doi.org/10.18178/joaat.4.2.111-122

DeCanio, S. J. (2016). Robots and Humans – Complements or Substitutes? *Journal of Macroeconomics*, *49*, 280-291. https://doi.org/10.1016/j.jmacro.2016.08.003

Defita, I., & Adnan, M. F. (2023). Evaluation of the Implementation of the Subsidized Fertilizer Distribution Program for Farmers in Sungai Tarab District. *Management and Public Administration Magazine*, *5*(1), 74-80. https://doi.org/10.24036/jmiap.v5i1.606

Futri, I. N., Risfandy, T., & Ibrahim, M. H. (2022). Method Article Quota Sampling Method in Online

Household Surveys. *MethodsX*, *9*, 101877. https://doi.org/10.1016/j.mex.2022.101877

Kurniawan, R., Anas, I., Widiyastuti, R., & Sutandi, A. (2017). Substitution of Inorganic Fertilizer in SRI Paddy Cultivation Effect on Growth, Production and Soil Organisms. *Jurnal Ilmu Tanah dan Lingkungan*, *19*(1), 46-50. https://doi.org/10.29244/jitl.19.1.46-50

Lan, C., Zou, J., Xu, H., Qin, B., Li, J., Chen, T., Weng, P., Lin, W., Shen, L., Wang, W., Huang, J., Fang, C., Zhang, Z., Chen, H., & Lin, W. (2024). Enhanced Strategies for Water and Fertilizer Management to Optimize Yields and Promote Environmental Sustainability in the Mechanized Harvesting of Ratoon Rice in Southeast China. *Agricultural Water Management*, *302*, 108956. https://doi.org/10.1016/j.agwat.2024.108956

Li, H., Huang, J., Zhang, C., Ning, X., Zhang, S., & Atkinson, P. M. (2024). An Efficient and Generalisable Approach for Mapping Paddy Rice Fields Based on Their Unique Spectra During the Transplanting Period Leveraging the CIE Colour Space**.** *Remote Sensing of Environment*, *313*, 114381. https://doi.org/10.1016/j.rse.2024.114381

Maertens, M., & Velde, K. V. (2017). Contract-Farming in Staple Food Chains: The Case of Rice in Benin. *World Development Journal*, *95*, 73-87. https://doi.org/10.1016/j.worlddev.2017.02.011

Mauki, C., Jeckoniah, J., & Massaw, G. D. (2023). Smallholder Rice Farmers Profitability in Agricultural Marketing Co-Operative Societies in Tanzania: A Case of Mvomero and Mbarali Districts. *Heliyon*, *9*(6), e17039. https://doi.org/10.1016/j.heliyon.2023.e17039

Misran, M. (2014). Pengaruh Penggunaan Pupuk Terhadap Pertumbuhan dan Hasil Padi Sawah. *Dinamika Pertanian*, *29*(2), 113–118. https://doi.org/10.25299/dp.v29i2.840

Muhardi, M., & Effendy, E. (2021). Technical Efficiency and The Factors Affecting It in Rice Production in Indonesia. *Asian Magazine of Agricultural and Rural Development*, *11*(3), 230-235. https://doi.org/10.18488/journal.ajard.2021.113.230.235

Mulwanyi, A., Hutagaol, P., & Sinaga, B. M. (2011). Impact of the Rice Purchase Policy on the Welfare of Producers and Consumers in Indonesia. *International Society for Agricultural Sciences of Southeast Asia (ISSAAS)*, *17*(2), 48-57. Retrieved from https://www.cabidigitallibrary.org/doi/pdf/10.5555/20123118830

Munanto, B. (2021). *Benefits of the Use of Organic Fertilizers. Medium Agricultural Extension Office of Food Security and Agricultural Extension, Forestry and Fisheries District*. Kulon Progo. Retrieved from https://kulonprogokab.go.id/v31/detil/3113/untung-pengguna-pupuk-organik

Murnita, M., & Taher, Y. A. (2021). Dampak Pupuk Organik dan Anorganik Terhadap Perubahan Sifat Kimia Tanah dan Produksi Tanaman Padi (Oriza sativa L.). *Menara Ilmu*, *15*(2), 67-76. https://doi.org/10.31869/mi.v15i2.2314

Ngango, J. (2022). Does Empowering Women Improve Yields and Income? Evidence from Rice Farmers in Rwanda. *Asian Journal of Agricultural and Rural Development*, *12*(3), 201-209. https://doi.org/10.55493/5005.v12i3.4602

Novi, V. (2023). *Understanding Profitability: Goals, Benefits, Functions, and Types*. Gramedia Blog. Retrieved from https://www.gramedia.com/literasi/pengertian-profitabel/

Nyakwawa, C., Mulagha-Maganga, A., & Mangisoni, J. H. (2022). Profit Inefficiency of Goat Farming in Malawi: A Bayesian Approach. *Heliyon*, *8*(11), e11318. https://doi.org/10.1016/j.heliyon.2022.e11318

Padmanabha, I. G., Arthagama, I. D. M., & Dibia, I. N. (2014). Influence of Dose of Organic and Nonorganic Fertilizers to Yield of Rice (Orizasativa L.) and Soil Chemical Compound on Inceptisol Kerambitan Tabanan. *Jurnal Agroekoteknologi Tropika*, *3*(1), 41-50. Retrieved from https://ojs.unud.ac.id/index.php/jat/article/view/7966

Pratama, N., Zulfaneti, Z., & Umiyat, E. (2021). Welfare Analysis of Rice Farmers in Warm Water District East Kerinci Regency. *Economic Paradigm Magazine*, *6*(4), 705-716.

Putri, C. K., & Noor, T. I. (2018). Analysis of Income and Welfare Level of Paddy Rice Farmers by Land Area in Sindangsari Village, Banjarsari District, Ciamis District, West Java province. *Agroinfo Galuh Magazine*, *4*(3), 927-935. https://doi.org/10.25157/jimag.v4i3.1678

Qadir, A., Suhartanto, M. R., Widajati, E., Budiman, C., Zamzami, A., Rosyad, A., & Diaguna, R. (2024). Commercial Rice Seed Production and Distribution in Indonesia. *Heliyon*, *10*(3), e25110. https://doi.org/10.1016/j.heliyon.2024.e25110

Rahnanita, G., & Syamsyah, N. (2018). Tingkat Efisiensi Teknis Usahatani Padi Sawah di Desa Tambakjati, Kecamatan Patokbeusi, Kabupaten Subang, Provinsi Jawa Barat. *Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, *4*(2), 169–183. Retrieved from https://jurnal.unigal.ac.id/index.php/mimbaragribisnis/article/view/1036/1192

Rozi, F., Santoso, A. B., Mahendri, I. G. A. P., Hutapea,

R. T. P., Wamaer, D., Siagian, V., Elisabeth, D. A. A., Sugiono, S., Handoko, H., Subagio, H., & Syam, A. (2023). Indonesian Market Demand Patterns for Food Commodity Sources of Carbohydrates in Facing the Global Food Crisis. *Heliyon*, *9*(6), e16809. https://doi.org/10.1016/j.heliyon.2023.e16809

Sadoulet, E., & Janvry, A. D. (1995). *Quantitative Analysis of Development Policy*. The Johns Hopkins University Press.

Saha, P., Hossain, M. E., Prodhan, M. M. H., Rahman, M. T., Nielsen, M., & Khan, M. A. (2022). Profit and Loss Dynamics of Aquaculture Farming. *Aquaculture*, *561*, 738619. https://doi.org/10.1016/j.aquaculture.2022.738619

Salam, M. A., Sarker, M. N. I., & Sharmin, S. (2021). Do Organic Fertilizer Impact on Yield and Efficiency of Rice Farms? Empirical Evidence from Bangladesh. *Heliyon*, *7*(8), e07731. https://doi.org/10.1016/j.heliyon.2021.e07731

Salam, M., Rukka, R. M., Samma, M. A. K., Tenriawaru, A. N., Rahmadanih, R., Muslim, A. I., Ali, H. N. B., & Ridwan, M. (2024). The Causal-Effect Model of Input Factor Allocation on Maize Production: Using Binary Logistic Regression in Search for Ways to Be More Productive. *Journal of Agriculture and Food Research*, *16*, 101094 https://doi.org/10.1016/j.jafr.2024.101094

Shen, X., Yang, Q., Ao, R., & Gong, S. (2024). Rural Labor Migration and Farmers' Arrangements of Rice Production Systems in Central China: Insight from the Intergenerational Division of Labor. *Journal of Integrative Agriculture*, *23*(9), 3200-3214. https://doi.org/10.1016/j.jia.2024.07.042

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, *70*(1), 65-94. https://doi.org/10.2307/1884513

Suharyanto, S., Mahaputra, M., & Arya, A. (2015). Relative Economic Efficiency of Lowland Rice Crop Using the Profit Function Approach in the Field School Integrated Crop Management Program in Bali Province. *Agricultural Informatics*, *24*(1), 59–66. https://doi.org/10.21082/ip.v24n1.2015.p59-66

Sulistiyawati, R., Kusrini, N., & Imelda, I. (2021). Influence of Farmer Characteristics and Management Capacities on the Welfare of Rice Farmers. *Journal of Economic Development Analysis*, *4*, 403-412. https://doi.org/10.15294/edaj.v10i4.47408

Syaiful, M., Damanik, D., Saragih, E. C., Fitriani, F., Nugroho, H., Guampe, F. A., Hikmah, H., Poluakan, M. V., Pattimahu, T. V., Sudirman, A., Ladjin, N., Sumario, S., Kundhani, E. Y., & Moridu, I. (2022). *Introduction to Economics*. Publisher Media Sains Indonesia. Retrieved from file:///C:/Users/Master/Downloads/BukuDigital-PengantarIlmuEkonomi.pdf

Utami, S. N. (2021). *Positive and Negative Impacts of the Use of Chemical Fertilizers*. Retrieved from https://www.kompas.com/skola/read/2021/06/16/090000269/dampak-positif-dan-negatif-pengguna-pupuk-kimia?page=all

Wang, S., Sun, N., Zhan, S., Longdoz, B., Wellens, J., Meersmans, J., Colinet, G., Wu, L., & Xu, M. (2024). Soil Organic Carbon Storage Impacts on Crop Yields in Rice-Based Cropping Systems Under Different Long-Term Fertilization. *European Journal of Agronomy*, *161*, 127357. https://doi.org/10.1016/j.eja.2024.127357

Wilujeng, E. D., & Fauziah, E. (2021). Technical Efficiency and Factors Influencing Rice Production in Lamonga Regency. *Journal of Agriscience*, *1*(3), 712-727. https://doi.org/10.21107/agriscience.v1i3.11179

Zakirin, M., Yurisinthae, E., & Kusrini, N. (2013). Analysis of Rice Farming Risks on Tidal Land in Pontianak Regency. *Jurnal Social Economic of Agriculture*, *2*(1), 75-84. https://doi.org/10.26418/j.sea.v2i1.5122