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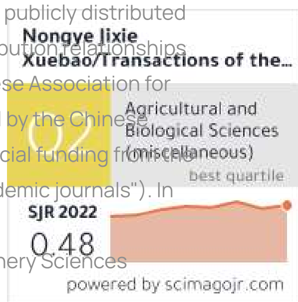

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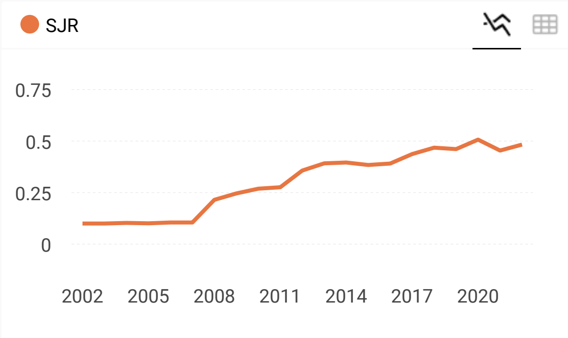

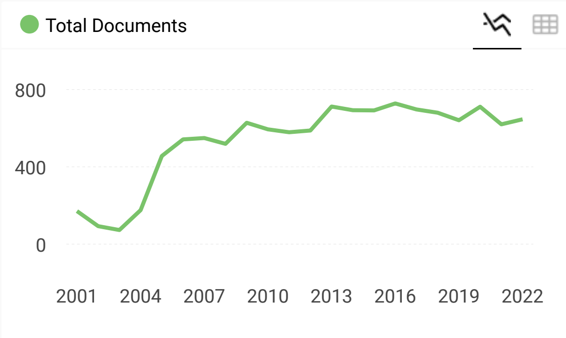

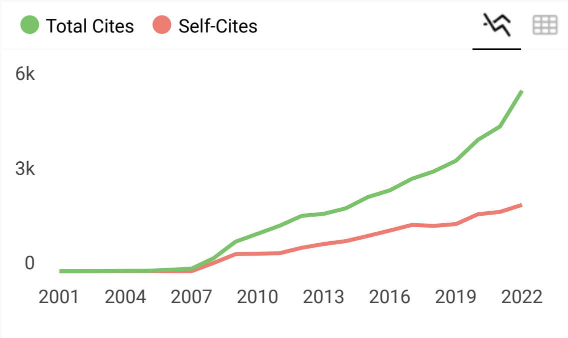

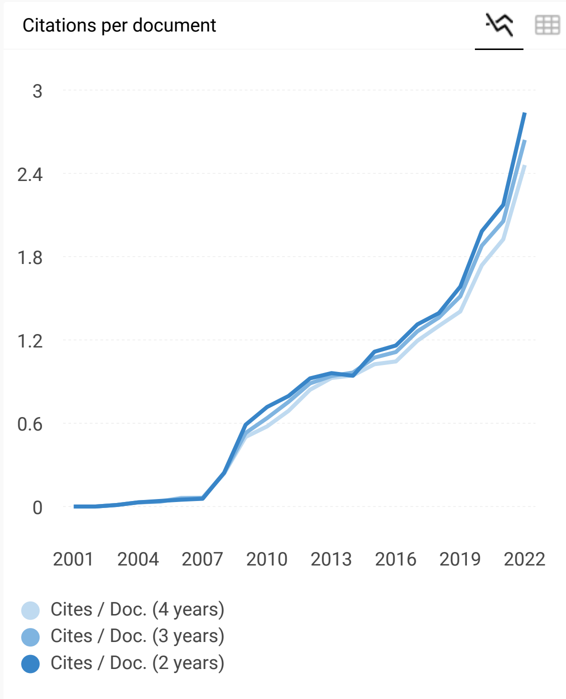

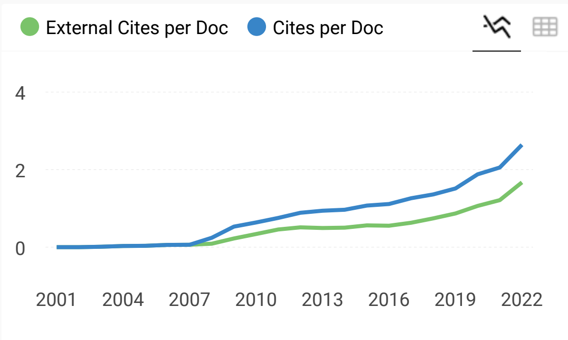

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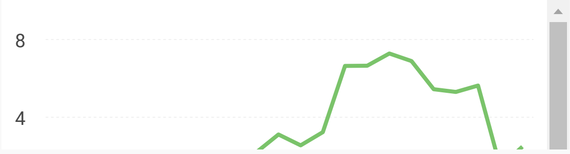

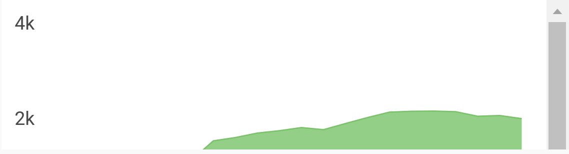

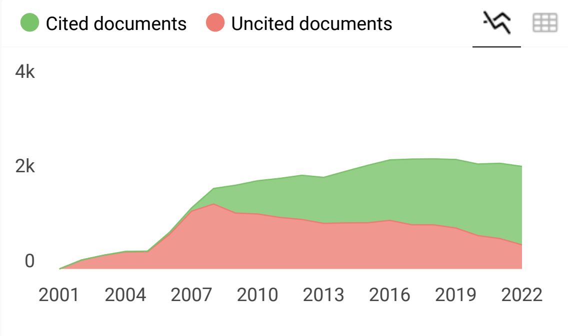

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Research article
Rural management and agricultural development: Trade

The Surplus Producer as a Measure of Household Welfare Levels in Rice Crops: A Case Study of Rice Cultivation on Low and Medium Lands

Suparmin Jinem[1], Tajidan Tajidan[2]
(1. Faculty of Agriculture, University of Mataram, Mataram, 83124, Indonesia; 2. Master's Study Program in Agribusiness, University of Mataram, Mataram, 83124, Indonesia)

Abstract: The objective of this study is to find an appropriate surplus producer analysis model to measure farmer family welfare levels in paddy rice fields on low and medium lands. The study was implemented in Indonesia with the lead location of low and medium lands of rice fields on Lombok Island. Low-land rice fields are represented in Kediri district, while medium-land rice fields are represented in Narmada district. In each district, 30 rice farming units were chosen; the number of the sampling units was 60 rice farming units. The data were collected using observation, survey, and interviews, where the respondents were farmers of paddy rice fields. Data analyzed using improvement profit function to become surplus producer function. This study showed that the appropriate model of analysis of the surplus of the producer as a measurement of paddy rice field farmer family well-being is ½ ∫(P - MC)*Q. This model can be applied to rice paddy agriculture such as rice paddy farmer household welfare level on the low land higher than on the middle land.
Keywords: household; rice; farmers; agriculture

过剩生产者作为水稻作物家庭福利水平的衡量标准：中低地水稻种植的案例研究

Suparmin Jinem[1], Tajidan Tajidan[2]
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2. 马塔兰大学农业企业硕士项目，马塔兰，83124，印度尼西亚）

摘要:
本研究的目的是找到一个合适的剩余生产者分析模型来衡量中低地水稻田农民家庭福利水平。该研究在印度尼西亚实施，主要地点是龙目岛的低中稻田。低地稻田以凯迪里区为代表，而中地稻田则以纳尔默达区为代表。每个区选出30个水稻种植单元；抽样单位数为60个水稻种植单位。这

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些数据是通过观察、调查和访谈收集的，受访者是水稻田的农民。使用改进的利润函数分析数据成为剩余生产者函数。本研究表明，作为衡量水稻田农民家庭幸福感的生产者盈余分析的适当模型是½ ∫(P -三菱商事)* 问。该模型可应用于稻田农业，如低地稻农家庭福利水平高于中地。

关键词：家庭; 米; 农民； 农业

1 Introduction

The decline in the area of agricultural land in Indonesia continues to this day, including in West Lombok Regency. This is because of ongoing industrial and housing development on a large scale. Ironically, this development uses productive agricultural lands. While productive agricultural land is very useful for the provision of food for regional and national residents. [1] stated that as reported by the Food and Agriculture Organization of the United Nations, in 2050, it is estimated that there will be an increase of 70% in global food needs. The first impact felt from the conversion of agricultural land into industrial land is reduced food production. The land conversion will make paddy fields and other agricultural land narrower, and agricultural land will automatically become narrower. According to [2], conversion of agricultural land can reduce rice production by 12.276 tons/ha/year in Majalengka Regency, West Java. Therefore, development considerations for the industrial and housing sectors should use non-productive land and maintain productive land. Therefore, the consideration of the adjustment of agricultural land for agricultural production in the future is important. The suitability factor of agricultural land for the suitability of various rice varieties and altitude needs to be considered by farmers. According to [3], land suitability is the suitability of a land for a particular use, e.g., irrigation, ponds, annual crop farming, or seasonal crop farming. Thus, land suitability for food crops needs information support.

Each plant can grow and adapt to the environment in which it is planted, including the altitude where it is cultivated. Although rice planting must be adjusted to the suitability of the planting site, the rice planting location must be able to produce high rice production. [4] classifies the altitude for agriculture into four classes, namely < 100 m, 100–200 m, 200–800 m, and > 800 m. Meanwhile, according to [5], the topography of West Lombok Regency, based on altitude, is divided into four: 0-100 m covering an area of 34,800 ha, 100-500 m covering an area of 40,966 ha, 500-1000 m covering an area of 8,650 Ha, and > 1000 m covering an area of 885 Ha. The data show that the area of agricultural land in the lowland areas still dominates, especially in the high-altitude areas (0-100 m and 100-500 m above sea level).

Land use that pays little attention to land suitability class, agroecology, and planting height tends to produce less optimal agricultural business and will even bring losses to farmers because it will use massive production factors to increase soil fertility. This is in line with [7], which states that the productivity of food crops depends on the quality of the land used. If the selection of land at the beginning of development does not select productive areas, considerable (financial) losses will occur later. Therefore, the evaluation of land suitability can show the level of land suitability for developing a commodity and economically, the feasibility of farming.

Besides the suitability of agricultural land, paddy rice pre- and postharvest issues also need attention. In the pre-harvest or rice production period, farmers are faced with seed problems (high-yielding varieties). The price of superior rice seeds makes it difficult for farmers to meet production targets. Superior rice varieties will produce high rice productivity. This rice seed problem can be overcome through the implementation of a price subsidy policy for certified rice seeds[8]. The government cooperates with state-owned enterprises and local breeders in each region in procuring and supplying subsidized certified rice seeds. The indicator of success in this program is the provision, sale and distribution of subsidized rice seeds to farmers or farmer groups. Likewise, [9] said that producing superior varieties and distributing them to farmers requires an efficient and effective formal seed system to obtain optimal benefits. Another policy during the pre-harvest period carried out by the government is the fertilizer subsidy policy. The provision of balanced fertilizer on rice plants will provide high production yields[10]. The government through the Ministry of Trade No. 4 of 2023 has stipulated the procurement and distribution of subsidized fertilizers for the agricultural sector. According to [11], the implementation of the distribution of fertilizers to farmers as a whole is quite effective and efficient, but sometimes, the quantity and price are not right and the flow does not comply with the official provisions set by the government.

The problem during the post-harvest period of rice is that in general the facilities owned by farmers in grain management are still inadequate, such as not having a drying floor and not having grain storage warehouses. This will impact marketing, revenue, and profits for lowland rice farmers. [12] states that in general, farmers have characteristics in marketing the results, where the bargaining position of rice farmers tends to be weak. The failure of the local grain market is a strong reason for the need for government intervention in the grain and rice markets. [13] stated that the government is very interested in controlling the stability of rice supply and prices for farmers through protective and promotive grain or rice policies, all of which have a direct or indirect impact on their welfare. Therefore, the government has provided support for grain prices or the basic price of grain for farmers every year so that the price of grain received by farmers is not too low.

From the various problems faced by farmers and the implementation of various government policies both during the pre- and post-harvest periods, it will be able to have an impact on the income and welfare that farmers expect. [15] stated that the welfare of farmers will be achieved if each farmer can meet the desired rice price target, which can be seen in the desired farmer's net income. Unfortunately, the price of unhusked rice (paddy), which is desired to meet the welfare of farmers, cannot be separated from the "forces" that play in various fields. This is a big problem for farmers because a weak bargaining position makes farmers unable to receive prices that agree with expectations, which can threaten farmers' income and welfare. The problem that arises is whether the suitability of the height of the rice planting area (low and medium land) in West Lombok Regency will result in production, profit, and producer surplus (welfare) for farmers from different lowland rice farming. Therefore, it is necessary to conduct this study.

Its objective was to find an appropriate producer surplus analysis model as a measure of the welfare level of paddy rice farming households in the lowlands and medium land. In particular, this study aims to analyze the differences in production and profit and find differences in the producer surplus of rice farming on the low and medium lands.

The results of this study add to knowledge and make it easier to analyze producer surplus for academics and practitioners in all types of household-scale farming.

2 Materials and Methods

2.1 Research Subject

This research was conducted in West Lombok Regency, West Nusa Tenggara, Indonesia. The research topic was cultivation grown during the 2021/2022 rainy seasons.

2.2 Research Design

The research was designed using an explanatory method, that is, research that explains and relates one variable to another that is different but interrelated and produces a causal relationship[8].

The main variables that are connected and sought for correlation are the level of production and paddy production factors: profit with productivity, cost of labor, cost of capital, surplus producers, which connect production with paddy price.

The research locations were determined in stages (multistage purposive sampling) ranging from the districts and sub-districts to the village level. The selection of districts was based on the production centers of paddy, thus West Lombok Regency was selected. Additionally, two sub-districts/villages were selected, which cultivate the paddy; each sub-district/village is expected to represent low land (< 100 mpl) and middle land (100–500 mpl)[5,16]. The location selection was based on the height of the area and the result of previous research that the altitude of the area affects the production, income, and producer surplus in paddy farming (Fig. 1). On the basis of these considerations, Jagaraga Indah village in Kediri Subdistrict was chosen to represent the lowland area, and Grimax Indah Village in Narmada Subdistrict was chosen to represent the Midland area.

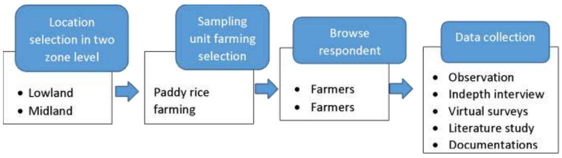

Fig. 1 The research stages

2.3 Research Respondents

Farmers, who were the research object, cultivated paddy during the rainy seasons in 2021/2022 and had experience in cultivating it. Initial information on the paddy farmers was obtained from farmers' groups in each sample village. Then, we randomly selected (random sampling) each 30 respondent farmers with the criteria according to the aforementioned provisions. Therefore, the research obtained 60 respondents.

2.4 Data Collection

The data collection was carried out by combining several methods simultaneously, namely observation, virtual survey, in-depth interview, literature studies, and documentation. Observations were made through direct observation at the location of the farm and where the farmer lives. The survey was conducted by interviewing rice farmers using a list of questions, while in-depth interviews were conducted to verify the data with the documents or records of their farming, documentation activity of farmers in the fields, and collected information from West Lombok District Agriculture Office.

2.5 Procedure for the Data Analysis

Measuring the welfare of lowland rice farmer households through producer surplus starts from measuring production using the Cobb-Douglas production function. Then, the profit of rice farming is measured through the Unit Output Price Cobb-Douglas Profit Function (UOP-CDPF) technique. Finally, we measure the welfare of producers through the measurement of the producer surplus, which is derived from the profit function.

Fig. 2 The stages of producer surplus

2.5.1 Variables and Data Analysis

The data collected from the survey were then edited, tabulated, and analyzed. The analysis model used is:

1) Cobb-Douglas production and profit functions. Yotopoulos and Lau (1979) in [17] and [18] state that the profit function can be derived using the Unit Output Price Cobb-Douglas Profit Function (UOP-CDPF) technique, with the assumption that producers maximize satisfaction for profits. UOP-CDPF is a function that includes production and factors of production normalized to output prices.

2) Cobb-Douglas Production Function with four independent variables, namely seed costs, fertilizer costs, labor costs, and the dummy variable altitude.

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

where:
q - output quantity;
X - quantity of the variable input;
Z - quantity of the fixed input;
α - intercept (constant);
β and ϒ - elasticity of output from input X and Z.

The empirical model of the Cobb-Douglas Production Function in this analysis is shown in the following equation:

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

To facilitate the estimation of equation (12) and data on the production distribution and determination of the normal distribution, the equation is transformed into a linear form by making it with logarithms; then, the equation becomes:

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

where:
qi - paddy production (kg) at altitudes of < 100 m and 100-500 m;
α – constant;
Xi - cost of production factors (seeds, fertilizers, labor) (Rp);
Zi - fixed costs (Rp);
Di - 1 for an altitude of 100-500 m and 0 for an altitude of < 100 m.

2.5.2 Receiving Function

$$R = p*q$$
$$R = p*\int \alpha X\beta Z\Upsilon$$

where:
R – revenue;
p – prices;
q - quantity of production;
X - quantity of the variable input;
Z - quantity of the fixed input;
α - intercept (constant);
β and ϒ - elasticity of output from input X and Z.

2.5.3 Cost Function

$$C(q) = vZ + wX \quad (4)$$

where:
v - capital rent for fixed input;
w - price of variable input.

2.5.4 Profit Function

$$\pi(X,Z) = pq - C(q)$$
$$= Pf(X,Z) - (\omega X) \quad (5)$$

where:
π – profits;
p - output price per unit.

If ω = ω/p means the normalized price of the input variable, then equation (3) can be normalized with the output price so that the output price profit (UOP Profit) becomes:

$$\pi/p(X,Z) = pq - C(q)$$
$$= pf(X,Z) - (\omega/vX) \quad (6)$$

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

$$\pi = p\int\alpha X\beta Z\Upsilon - \omega X$$
$$\partial\pi/\partial X = \beta p\int\alpha X\beta\text{-}1\ Z\Upsilon - \omega = 0 \quad (7)$$
$$\beta p\int\alpha X\beta\text{-}1\ Z\Upsilon = \omega \quad (8)$$

Xβ-1 = [ω/βpʃα ZϒΥ] (9)
X* = [ω/βpʃα ZΥ] 1/β-1 (10)

Equation (8) indicates that the amount of input needed to obtain maximum profit depends on the output price, input price, and fixed input. By substituting equations 8 and 1, the optimum output will be obtained as follows:

q = αXβZΥ
q = α[(βα ZΥ P/ω) 1/β-1]β ZΥ
q = α[(α ZΥ) 1/β-1 (β.P/ω) β / 1-/β ZΥ/1-β]
q = α1/β-1[(β.P/ω) β/1-/β ZΥ/1-β] (11)

Equation (11) shows that the optimum amount of output produced to achieve maximum profit depends on output prices, input prices, and fixed costs Z, which is expressed as

X* = X*(p,ω,Z) (12)

By substituting equations (10) and (11) into the profit function, the maximum profit becomes

π* = p[α1/1-β[(β.P/ω) β/1-/β ZΥ/1-β] – ω[αβZΥ.v/ω] 1/1-β
= p[α1/1-ββ β/1-/β.(P/ω) β/1-/β ZΥ/1-β] – ω[α1/1-β β1/1-β ZΥ/1-β .(v/ω) 1/1-β]
= α1/1-β β β/1-/β (1-α) ZΥ/1-β P1/1-β ω -β/1-/β (13)

Equation 13 shows that the maximum profit (π*) received by farmers depends on the output price (p), input prices (v), and fixed inputs (Z)

The empirical model used in the profit analysis of rice farming is the Cobb-Douglas profit function model with the following equation:

πi = vα ωβ ZΥ Diᶲ (14)

To estimate equation (14) and data on the profit distribution and determine which is close to the normal distribution, the equation is transformed into a logarithmic form

ln πi = ln ƛ + α ln v + β ln ω + Υ ln Z + ᶲDi + εi (15)

where:
πi - rice farmer profit (Rp) at planting heights of < 100 m and 100-500 m, which is normalized;
ƛ - profit function line;
V - productivity of rice farming (kg/ha) on the low and medium lands;
ω - cost of capital (Rp/ha) for farmers in the lowlands and medium land;
Z - labor costs (Rp/ha) for farmers in the lowlands and medium land;
Di - 1 for farmers on the medium lands and 0 for farmers on the low lands.

The producer surplus is the difference between the prices of goods that producers can sell and the prices that producers can accept from the number of goods sold. Producer surplus also means the ability of producers to obtain revenue from goods sold at a sacrificed cost. Mathematically, the grain supply equation is made through the total cost equation. Generally, the cost function used is a cubed function, so the equation is as follows:

TC = C + β1Q1 + β2Q2 + β3Q3 (16)
MC = β1 + 2β2Q1 + 3β3Q2 (17)

where:
TC - total cost (Rp);
MC - marginal cost (Rp);
C - constant;
Q - amount of grain production (kg).

Because the marginal cost is equal to the supply, the supply equation is the same as equation (17). Maximum profit is achieved when price (P) equals marginal cost (P = MC).

Calculating the amount of producer surplus will use the following equation:

SP = δTR – δTC (18)
SP = MR – MC
SP = ½ ʃ(MR-MC)*Q
SP = ½ ʃ(P – MC)*Q (19)

where:
SP - producer surplus (Rp);
TR = P * Q = total revenue;
TC - total cost;
MR = marginal revenue = P;
P - equilibrium or market price of grain (Rp/kg);
MC - marginal cost.

3 Results

3.1 The Effect of Planting Altitude on Rice

Rice production can be influenced by how much production factors are used by farmers. In this study, the production factors used included rice seeds, fertilizers, labor, and the height of the planting site. The results of the regression analysis can explain the estimation of how much production factors are used and at what stage the return can be achieved. The estimation results are shown in Tab. 1.

Tab. 1 Estimated Factors of Rice Farming and Production in West Lombok Regency, 2022 (Primary data analysis)

Variables	Unstandardized Coefficients		t	Sig.
	B	Std. Error		
(Constant)	-.212	.790	-.268	.790
ln Seed Cost	.383	084	4,572	.000*
ln Fertilizer Cost	.198	.070	2,835	.006*
ln Labor Costs	.413	.067	6.127	.000*
Altitude Dummy	-.147	048	-3,085	.003*

Dependent variable: ln Production
Adjusted R^2 = 0.956
F = 320.029 *

* Significance at the 1% level

3.2 Empirical Results of Profit Models

Economic theory states that the profit received depends on the amount of income and costs incurred. The results show that the profit of rice farmers in the lowlands is higher than that of farmers in the medium land. The profit of farmers in the lowlands is 41.83% greater than rice farmers on the medium land, and the difference is significant with a p-value of 0.000 (Tab. 2).

The high profit of rice farmers in the lowland areas is due to higher revenues compared to farmers in the medium land. The income of farmers in the lowlands is 33.14% greater than that of rice farmers in the medium land and the difference is significant at a p-value of 0.000 (Tab. 2). The high income of farmers in the lowlands is due to the productivity and selling price of grain, even though the capital and labor costs are higher than those of farmers in the medium land.

Tab. 2 Profits from rice farming per hectare in West Lombok Regency, 2022 (Primary data analysis)

No.	Items	Rice Farmers		t-stat	p-values
		Lowland	Middle Land		
1.	Profit (Rp/ha)	17,901,111	12,621,165	-8,243	0.000
2.	Revenue (IDR/ha)	26,980,223	20,264,411	-9,448	0.000
3.	Productivity (kg/ha)	6,889	5.194	-10,229	0.000
4.	Capital Cost (IDR/ha)	1,379,869	2,437,595	11083	0.000
5.	Labor Costs (IDR/ha)	7,297,152	4,970,035	-9,064	0.000

The results show that the productivity of rice in lowland areas is higher than that of the rice farming on the medium land. The productivity of rice in the lowland areas is 32.63% greater than rice farmers in the medium land and the difference is significant with a p-value of 0.000 (Tab. 2). The average selling price of grain per kilogram received by farmers in the lowland areas is IDR 3,917, while for farmers on the medium land, it is IDR 3,897 per kg.

In general, the results show that the average cost of capital incurred by rice farmers in the lowland areas is lower than that of farmers on the medium land. The cost of capital for farmers in the lowlands is 43.39% lower than rice farmers in the medium land and the difference is significant with a p-value of 0.000 (Tab. 2).

The results show that the labor cost for rice farmers in the lowland areas is higher than that of farmers on the medium land (value of 0.000) (Tab. 2).

3.3 Effect of Planting Altitude on Rice Farming Profits

To test the hypothesis that there is an effect of planting height on the profit from rice farming, a statistical test of the profit function was carried out for groups of farmers in the lowlands and groups of farmers in the medium land, and a combination of farmer groups in the dummy variable. Testing the influence of productivity variables, capital costs, and labor costs on profits is made using the Cobb-Douglas profit function regression model, which is summarized in Tab. 3.

Tab. 3 Estimated profits earned by rice farming on low and middle lands in West Lombok Regency, 2022 (Profitability model analysis of two growing altitude areas and their combination in one analysis package shown by t-test statistics)

No.	Explanatory Variables	Farmer Profit Function		
		Low Land	Middle Land	Combined
1	Intercepts	11036 (0.742)*	13,402 (2,952)*	9,627 (1,660)*
2	Productivity (ln X1)	1,496 (0.059)*	1931 (0.243)*	1,540 (0.138)*
3	Cost of Capital Inputs (ln X2)	-0.004 (0.020)	-0.552 (0.152)*	-0.125 (0.061)**
4	Cost of Labor Input (ln X3)	-0.476 (0.046)*	-0.356 (0.112)*	-0.302 (0.079)*
5	Dummy of Planting Height	-	-	0.028 (0.061)
	Adjusted R^2	0.957	0.676	0.836
	F Calculation	214,294*	21.174*	76,296*
	Number of Observations	30	30	60

** The statistical significance at 5%
* The statistical significance at 1%. The dependent variable is ln Profit (π/ha).

3.4 Producer Surplus Analysis

The producer surplus is one measure to assess the welfare of producers or farmers. The producer surplus is very dependent on the production per hectare of rice or the level of productivity and the difference between the market price of grain and the minimum price of grain that producers are still able to accept. The results of the study (Tab. 4) can explain that the average productivity of rice yields in the two lands is very different where in the lowlands it is 32.63% greater than rice farmers in the medium land and the difference is significant with a p-value of 0.000 (Tab. 2). Next, the difference in productivity with production break-even point is quite large, where in the lowland areas the difference in production is 3539 kg/ha or 108% and in the medium land it is 2202 kg/ha or

73.57%.

Tab. 4 Producer surplus of rice farmers in West Lombok Regency, 2022 (Primary data analysis)

No.	Items	Rice Farmers		Combination
		Lowland	Middle Land	
1	Grain market price (IDR/kg)	3,917	3,897	3,907
2	Production break-even point (kg/ha)	3,270	2,993	3.316
3	Average productivity (Kg/Ha)	6,889	5.194	6,042
4	Producer Surplus (IDR1.000)	12,481	6,555	9,625

4 Discussion

The overall test results (Tab. 1) show that all independent variables (seeds, fertilizers, labor, and altitude) jointly affect the rice production. This information can be seen from the F value of 320,029, which is significant at the 99% confidence level or 1% error level. Also, the value of adjusted R^2 = 0.956, which means that 95.6% of the variation in the dependent variable (rice production) can be explained by the independent variables (seed costs, fertilizer costs, labor costs, and altitude). This also means that all of these independent variables affect the rice production in West Lombok Regency. In line with [19], all independent variables such as seeds, fertilizers, and labor jointly affect rice production in Central Sulawesi, Indonesia.

Partial testing (Tab. 1) through the t-test found the estimation results of the four independent variables, namely all of these variables had a significant effect on rice production. To determine how much influence each independent variable has, it can be explained as follows.

The cost of rice seeds: All the respondent farmers planted the Inpari 32 rice variety. Statistically, the estimated regression coefficient was 0.383 with a significance level of 0.000 (probability). This means that the variable cost of seeds has a significant effect on rice production, where each additional 1% of seed costs will increase rice production by 0.383%. However, if you look at the magnitude of the regression coefficient, the magnitude is still less than 1, which means that there are still opportunities for farmers to increase the use of seeds to achieve optimal production results. [20] state that the cost of rice seeds has a significant effect and has a positive contribution to rice production in irrigated land in Isabela Province, Philippines.

Fertilizer costs: Statistically, the estimated regression coefficient was 0.198 with a significance level of 0.006 (probability). This means that the variable cost of fertilizer has a significant effect on rice production, where every 1% additional cost of fertilizer will increase rice production by 0.198%. However, if you look at the magnitude of the regression coefficient, the magnitude is still less than 1, which means that there is still an opportunity for farmers to increase the use of fertilizers to achieve optimal production results. In accordance with [19], fertilizer inputs had a significant effect on the rice production in Central Sulawesi.

Labor costs: Statistically, the estimated results of the regression coefficient are 0.413 with a significance level of 0.000 (probability). This means that the labor cost variable has a significant effect on rice production, where every 1% increase in labor costs will increase rice production by 0.413%. However, if you look at the magnitude of the regression coefficient, the magnitude is still less than 1, which means that there are still opportunities for farmers to increase the use of labor to achieve optimal production results. In line with [20], labor costs have a significant effect and have a positive contribution to rice production in irrigated land in the Province of Isabela Philippines.

Planting height: Statistically, the estimated regression coefficient was -0.147 with a significance level of 0.003 (probability). This means that the variable height of the planting area has a significant effect on the rice production, where the medium land produces 0.147 times less rice than the lowland areas. This also means that higher areas where rice is planted produce lower rice production. According to [6], the number of productive tillers and grain filling in the highlands is lower than in the lowlands.

The regression model for the profit function for rice farmers in Tab. 3 shows that the value of the coefficient of determination R^2 for farmers in the lowland region is 0.957 and for farmers in the medium-land region is 0.676, and the combination in both regions is 0.836. This means that 95.70% of the variation in profits for farmers in the lowlands is then 67.60% of the variation in profits for farmers in the medium land, and 83.36% of the variation in profits for farmers in the two highlands can be explained by explanatory variables such as productivity of rice farming, capital costs, costs labor, and the height of the planting site. This means that there are 4.30% for farmers in the lowlands and 32.40% for farmers on the medium land.

Based on the results of the t-test or partial test, most of the variables included in the regression model have a significant effect on the profits from rice farming in West Lombok Regency. In addition to the significance observed, it is also necessary to pay attention to the magnitude and sign of the regression coefficient.

First, the productivity variable has a positive sign with a magnitude of more than 1. This means that every 1% increase in rice productivity will increase profits by 1.49% for groups of farmers in the lowland areas, 1.391% for groups of farmers on the medium land, and 1,540% for the combination of the two regions. This means that the increase in productivity provides an increase in profits from rice farming, which is more responsive or the elasticity is more than 1 and can be classified as elastic. This increase in productivity can be due to the use of production facilities in a balanced way, such as the use of Inpari 32 rice seeds, urea, ponska, and ZA.

Second, capital cost variables are negative with a magnitude of less than 1. This means that a 1% increase in the cost of capital will reduce profits by 0.004% for the lowlands, 0.552% for the medium land, and 0.125% for the combination of the two regions. The variable response of capital input costs for the medium-land region is greater than that for the lowland areas for the profit of rice farming. When compared to the average costs incurred by farmers for rice seeds and fertilizers, the average capital cost of the farmer group in the medium land is higher than that of the farmer group in the lowlands, which is IDR 329,667 compared to IDR 308,000 (the cost of rice seeds) and IDR 1,301,008.- compared to IDR 553,583.- (for the cost of fertilizer). There are allegations that excessive use of fertilizer costs at high prices has caused capital input costs to increase even more. [22] states that the capital cost factor has a significant effect on rice farming income in Rwanda. [23] state that the cost of capital or production facilities has a significant effect on the income of rice farmers in Gowa Regency, Indonesia.

Third, for variable labor costs, the magnitude is less than 1 with a negative sign. This means that every 1% increase in labor input costs will reduce rice farming profits by less than 1%, namely 0.476% for the lowland areas, 0.356% for the medium-land regions, and 0.079% for the combination of the two regions. This means that the use of labor in the lowlands is more than in the medium land, so that the response to profits is greater. [22] states that the labor cost factor has a significant effect on the income of rice farming in Rwanda.

Fourth, regarding the height of the rice planting area, the magnitude is less than 1 with a positive sign, meaning that in the medium land the response is 0.028 times greater than in the lowland areas to the profit of rice farming. However, this height variable does not significantly influence the profit of rice farming. This means that the profit from rice farming does not require a special place because the quantity of production and the selling price of grain determine the profit. The price of grain in the two regions is different, where the price of grain received by farmers in the lowland areas is an average of IDR 3,916.67 per kilogram, while in the medium land the average is IDR 3,896.67 per kilogram. This price difference is not too big (the results of the t-test on grain prices show a significance value of 0).

The difference in the price of grain received by farmers in the two regions is caused by the following:

1) Most farmers in the medium land area sell grain with relatively lower quality, namely the grain moisture content is still relatively high;

2) Producers are dealing with several wholesalers so that the bargaining position of farmers is still weak.

3) At harvest time, most farmers need money for household needs, for example for children's education, health, and social activities. In line with [8], in general, farmers have characteristics in marketing results, where the bargaining position of rice farmers tends to be weak because generally, farmers sell rice immediately after harvest in the form of dry grain harvest and even by slashing; farmers are faced with the need for cash for the cultivation of land in the next period. Therefore, the added value from post-harvest is mostly enjoyed by traders, and rice supply is not elastic and the rice market is segmented locally. Then, what often becomes a problem is the low quality of grain that is sold due to the high water content due to cloudy weather, which often occurs during the rainy season. The price range for grain received by farmers is between IDR 3,500/kg and IDR 4,100/kg in the medium land area. Meanwhile, farmers in the lowlands sell unhulled rice at prices ranging from IDR 3,900/kg to IDR 4,000/kg.

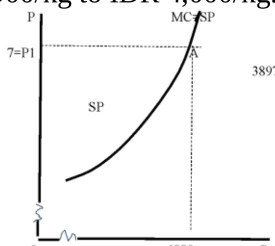

Fig. 3. Producer Surplus (SP) in the lowlands

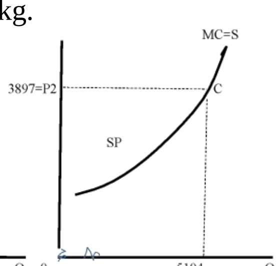

Fig. 4. Producer Surplus (SP) in the midland

To plan rice farming that provides maximum profit, farmers must be able to calculate the return point for farming or it is called the break-even point, where at this point it will be seen how far the farmer will estimate the profit to be obtained. The results of the production break-even point analysis are shown in Tab. 4. The break-even point of production in the lowland areas is higher than in the medium land areas, but the difference is not too stark. The results showed that the productivity of rice produced by farmers was still above the break-even point; this meant that farmers were able to generate revenue and income from the costs that were sacrificed. In other words, from the socio-economic size, farmers have been able to generate sufficient profits to carry out farming socio-economic activities at a later time, and this can be categorized as farmers who have achieved prosperity. In line with [23], the level of welfare of farmers in narrow, medium, and large areas has achieved a high level of welfare observed from socio-economic indicators or the Central Bureau of Statistics.

The previous description shows that the producer surplus in the lowland region is higher than that in the medium-land region. This shows that farmers in the lowlands are more prosperous than farmers in the medium land. The magnitude of this producer surplus can be interpreted as the government's success in establishing a policy to increase rice production and at the same time, the welfare of rice farmers through several policies including subsidizing the price of urea fertilizer, increasing the purchase price of grain for farmers, increasing the area for rice planting, and increasing irrigation areas. Besides, the farmers also play a role in improving their welfare, such as managing farming well from preparing rice seeds, maintaining planting, and fertilizing properly to harvest handling. In line with [24], the capacity of farmers affects the welfare of farmers, namely their abilities such as cultivation techniques, capabilities from seeding, planting, weeding, and fertilizing to handling plant pests. [21] said that a combination of government policies through increasing irrigation areas, increasing the purchasing price of farmers' grain, increasing the rice planting area, and decreasing the price of urea fertilizer led to a larger producer surplus. [14] also stated that the level of welfare of paddy rice farming households was medium.

5 Conclusions

The producer surplus analysis model 1/2∫(P-MC)*Q can be used as a measurement of the welfare of paddy rice farming households. The welfare of rice farming households in lowland areas is higher than that of lowland rice farming households in medium-land areas. In measuring the welfare of paddy rice farming households, the 1/2 equation model can be used: ∫(P-MC)*Q.

There is evidence that the height of lowland rice cultivation has a significant effect on the lowland rice production. The productivity of lowland rice farming in the lowlands is higher than that of lowland rice farming in the medium land. The results of this study recommend that the government prevent land conversion from agriculture to non-agriculture in lowland areas, preferably housing and industrial development locations on unproductive land.

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