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Efficency Analysis of Rice Production and Farmers' Income in Sengah Temila District Landak Regency

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Abstract

The low production of rice in Sengah Temila District of Landak Regency makes farmers' income low. The purpose of this research was to analyze production, efficiency (technical, price and economy) and farmer income. The approach used in this research was quantitative approach. The production analysis used Cobb-Douglas's production function with multiple linear regressions. Technical efficiency analysis used frontier production function with Stochastic Frontier Analysis (SFA). Allocative efficiency analysis used comparative analysis of marginal product value and input price. Economic efficiency analysis used the combination of technical efficiency and allocative efficiency. The income analysis used the difference between revenue and cost. The results showed that the average production of rice in Sengah Temila District Landak Regency was quite good with production of 5.819 kg/ha. The factors that affect the production level significantly ware the land size, seeds, pesticides and labors while the fertilizer factor had no significant effect because of quantity of fertilizer was less than needed. Land size was dominant factor that affect the production level. Technical efficiency was not yet efficient but it was nearly efficient with coefficient 0.96. Inefficiency of technical becuase of quantity of fertilizer was less than needed and over capacity of land. Based on allocative efficiency, the rice farming was far from efficient due to the high price of production factors, especially fertilizer and labor with coefficient 19.24. Economic efficiency was not efficient with coefficient of 18.38. Farmer' income was Rp1,385,900.00 per household per month. Farmer' income was lower than the regional minimum wage (UMR) of Landak Regency in 2017 which was Rp2,000,920.00.

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INTRODUCTION

The agricultural sector is the primary support of Gross Domestic Product (GDP) of traditional based developing countries in general. According to Ervani (2013), Indonesia's agricultural commodities show positive values for Trade Balance Index (TBI) of export-import volume and export-import value. This means that Indonesia is referred to as a net-exporter and specializes in the export of agricultural commodities. Therefore, the government should attract investment in the agricultural sector to encourage economic growth (Nasir et al., 2017). But on the other hand, the conversion of agricultural land into industrial land and housing is also unavoidable resulting in decreasing agricultural yield (Priyanto et al., 2014).

Food is the basic need that must be fulfilled so that people can survive and productive. One way to achieve food security is by utilizing agricultural resources as effectively and efficiently as possible so they will yield optimal production. Rice is a strategic food commodity that continues to receive special attention from the government since rice is the staple food for most of Indonesia's population. According to Kusuma (2012), increasing rice supply, rice production and price will increase food security.

Landak Regency is the second largest rice producing regency in West Kalimantan Province with harvested area of 46171 ha producing 188436 tons with average production of 4081 kg/ha (BPS West Kalimantan Province, 2017). The agricultural sector in Landak Regency gives the largest contribution to GDP of 35.13% (BPS Landak, 2017). This shows that the agricultural sector is a leading sector in Landak Regency. Landak Regency continues to make efforts to be a rice-producing region with many potentials, including: (1) large and potential land for the development rice cultivation, (2) many human resources because agriculture is the main source of income, (3) many available water resources, (4) the accessibility to the district capital is relatively good.

Gross Regional Domestic Product (PDRB) per capita is one of the indicators used to measure the level of society's prosperity. The PDRB of Landak Regency in 2016 is Rp20.821.226,00 or Rp1.735.102,00 per month with regional minimum wage (UMR) Rp2.000.920,00 (BPS Landak Regency, 2017). This indicates that the income of the society is still low because it is still below UMR.

Sengah Temila district is one of the districts located in Landak Regency and has the widest area of rice field that is 13144 ha. However, from that total area of the land only 7583 ha (57.69%) is used (BPS Landak Regency, 2017). Agricultural development continues to be pursued by Landak Regency Government through development of agricultural facilities and infrastructure but the results had not been fully successful. This is due to various factors. According to Suratiyah (2016: 19), the factors that affect farming are natural factors, labor force and capital. Suartiyah further said in rice farming at least there are five factors of production used, such as land, seedlings, fertilizers, pesticides and labors.

Efficiency is a measure of the level of resource usage in a process. Large production does not necessarily mean high efficiency. According to Nicholson (2002: 427), an activity is said to be efficient if the implementation of the activity reached the target (output) with the lowest effort (input), so efficiency can be interpreted as the absence of waste. Farel and Timmer in Sucihatiningsih (2013: 8), said that efficiency can be divided into three namely technical efficiency, price (allocative) and economical.

The amount of production is the main factor affecting the income of farmers. According to Leovita et al. (2015), commodity production is determined by the allocation of input's effectiveness. The level of input's allocation will have an impact on the production and then the farmer's income. This is in line with Anggraini et al. (2016), where efficiency is one factor that plays an important role in determining the level of productivity. In addition, according Sobichin (2013), the very high disparity between the price of grain and the price of rice causes the income of farmers decreased. Farming is said to be successful if it can fulfill the obligation to pay the capital's interest, tools, wages of labor and other production facilities including obligations to third parties and

can maintain business sustainability (Suratiyah, 2016: 77).

The cost function illustrates the relationship between the sum of cost and the production rate. As with the production function, at this cost is known as the concept of marginal cost and average cost. Marginal cost (MC) is the change of cost, per unit of production cost change, while average cost (AC) is the cost of every production unit. Beside that there is also something called marginal variable cost (MVC) which will be similar with (MC), marginal fixed cost (MFC) which is equal to zero, average variable cost (AVC) and average fixed cost (AFC).

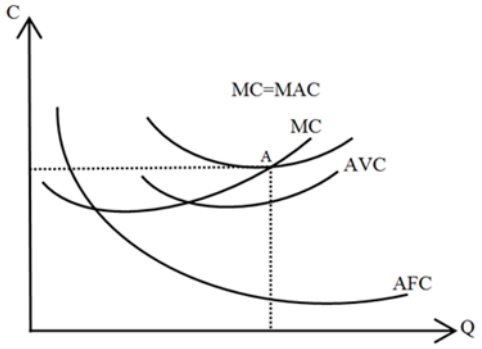

Figure 1. Marginal cost function

The biggest profit is obtained when MC is equal to production cost with the assumption of the perfect competition market.

The objectives of the research were: (1) to analyze the level of rice production in Sengah Temila district Landak regency (2) to analyze the factors affecting production level, (3) to analyze the efficiency level (technical, price and economy) and (4) to analyze income level of farmers income.

METHODS

The approach used refers to quantitative research. Quantitative methods used to analyze production levels, efficiency and income of the farmers.

The population used the number of households (KK) whose profession was mainly as rice farmers as many as 12.919 households. To determine of the sample size the Slovin formula was used with 10% margin of error so that the sample obtained was as many as 99.23 (rounded up to 100). The sampling technique used simple random sampling technique with the sample farmers as the unit of analysis.

Independent variables in this study ware the area of land, seedlings, fertilizers, pesticides and labor while the dependent variable was the amount of production. The data collection techniques used were interview techniques, questionnaires and observations. Interview technique used to obtain descriptive data about farming problems faced by the farmers. Questionnaire technique used to obtain data about production, production cost, selling price and farmers' income. Observation technique used to obtain data about the characteristics and methods used by the farmers.

Operational description of the research used were: (1) production in kilogram (kg), (2) land area in hectares (Ha), (3) seed in kilogram (kg), (4) fertilizer in kilogram (kg)), (5) pesticide in units of milliliters (ml), (6) labor in labor's working days units (HOK), (7) production cost in units of rupiah (Rp), (8) selling price in rupiah (Rp) and (9) income in rupiah (Rp).

In this research there were three steps of analysis namely the analysis of production, efficiency analysis and income analysis.

Production Analysis

Production analysis based on Cobb-Douglass' production function with multiple linear regression analysis. The regression model is as follows.

$$Y = \beta_0+\beta_1X_1+ \beta_2X_2+ \beta_3X_3+ \beta_4X_4+ \beta_5X_5 + \mu$$

Where :

Y = production (kg)
β = coefficient
X_1 = land size (ha)
X_2 = seedlings (kg)
X_3 = fertilizer (kg)
X_4 = Pesticide (ml)
X_5 = Labor's work days (HOK)
μ = margin of error

Efficiency Analysis

1) Technical efficiency

The technical efficiency analysis used the frontier production function with Stochastic Frontier Analysis. The following was the equation

model according to Aigner et al. in Sucihatiningsih (2013: 14).

$\ln(Yi) = Xi\beta + vi - \mu i$

Where :

ln(Yi) = Output logarithm value

Xi = numbers of input

Bi = estimated perimeter

μi = positive random variable

vi = random error

The ratio of output observation to the i-firm relative to the potential output, was indicated by the frontier function of the existing input so that it can be formulated the technical efficiency value (TE) as follows.

$$TE = \frac{Yi}{\exp(Xi\beta)} = \frac{\exp(Xi - \mu i)}{\exp(Xi\beta)} = \exp(-\mu i)$$

2) Allocative efficiency

The allocative efficiency analysis (price) used to compare the value of the marginal productivity of each input (NPMxi) with the input price (Pxi). Here is the mathematical formula according to Soekartawi (2016: 97).

$$\frac{NPMx}{Px} = 1 \rightarrow \frac{bYPx}{X} = Px \rightarrow \frac{bYPx}{XPx} = 1$$

Where

b = elasticity

X = Number of X's production factor

Y = production

PX = The price of X's production factor

PY = The price of Y's production

From the equation above, therefore price efficiency calculation is as follows.

$$EH = \frac{NPM1+NPM2+NPM3+NPM4+NPM5}{5}$$

3) Economic Efficiency

The economic analysis used the combination of technical efficiency and price efficiency. Here is the mathematical formula according to Soekartawi (2001: 49).

EE = ET x EH

Where :

EE = Economic efficiency

ET = Technical efficiency

EH = Allocative (price) efficiency

3. Income Analysis

The income analysis used the nominal approach which is the difference between revenue and cost. Here is the calculation model.

Income = Total revenue – Total cost

Revenue = Py . Y

Py = Production price (Rp/kg)

Y = Production (kg)

Total cost (TC) = Fixed cost (FC) + Variable cost (VC).

RESULT AND DISCUSSION

Production

Every farmer hopes to utilize the land as much as possible to obtain an optimal yield. Various efforts done continuously to obtain maximum results such as the use of superior seeds, fertilizers and pesticides. Here are the production and inputs used in the cultivation of rice crops in Sengah Temila District.

Table 1. Production and Use of Rice Field Production Factors in Sengah Temila District

No.	Land Area (Ha)	Frequency	Seedling (Kg)	Fertilizer (Kg)	Drug (mL)	Labor (HOK)	Production (Kg)
1	0.3	14	10.5	73.2	264.3	37.9	1757.1
2	0.4	29	13.8	110.7	326.9	51.9	2360.3
3	0.5	37	17.9	120.5	371.9	67.0	3006.8
4	0.6	20	20.9	150.3	465.0	71.4	3350.0
$\bar{X}$	0.45	-	15.8	113.7	375.0	57.1	2618.6
Conversion of 1 Ha of land			35.1	252.7	793.3	126.9	5819.1

The production of rice in Sengah Temila District is 2618.6 kg with land use 0.45 ha with productivity 5819 kg/ha. According to BPS (2017), national productivity of paddy is 5300 kg/ha. While the productivity of paddy field of Landak Regency is 4081 kg / ha (BPS West Kalimantan Province, 2017). This indicates that Sengah Temila rice production is better than national and regency production. However, when compared to the production according to the type of seed used, the production cannot be qualified as good because the production is lower than the average production of seed types used. The type of seeds used by farmers in Sengah Temila district are INPARI with average production of 6000-8000 kg / ha (BBPTP, 2017).

Production of rice in Sengah Temila district was also lower than other regions because the production of rice in other areas shown the average above 6000 kg/ha and even more than 8000 kg/ha. Based on the results of research Suzana et al. (2011), that rice production in North Domuga District is 6100 kg/ha. Furthermore, Prabandari et al. (2013), shows that the productivity of rice in Subak Mambal is 6462.8 kg/ha. Then the research of Bahasoan (2013), shows that the productivity of rice in Buru regency is 6245 kg/ha.While the research of Yoko et al. (2014), indicates that the production of rice in Central Lampung Regency is 6080 kg/ha.

To determine the relationship between variables, multiple linear regression analysis used Eviews version 9.

Based on the results of multiple linear regression test, can be concluded that the independent variables i.e. land area, seeds, fertilizers, pesticides and labor altogether influence the production. Partially variable of land size, seed, pesticide and labor had significant effect to production. While the fertilizer was stated to had no significant effect on rice production. The coefficient of multiple determination (R-Squared) is 0.98 which means 98% of rice production was affected by the land size, seeds, fertilizers, pesticides and labor while 2% is influenced by other factors.

Partially, the land size had significant effect to rice production and positive correlation. Land size is the factor that has the most dominant influence on rice production. The results of this study were in line with previous research such as Burhansyah (2016), where the real size of land affects rice production in Sebubus Village, Sambas Regency.

Table 2. Result of Multiple Linear Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	315.3479	57.75358	5.460230	0.0000
X1 (land area)	6457.345	696.3981	9.272491	0.0000
X2 (seed)	-24.46568	9.457332	-2.586954	0.0112
X3 (fertilizer)	1.249077	0.965037	1.294331	0.1987
X4 (pesticide)	-3.501267	0.401573	-8.718891	0.0000
X5 (labor)	15.62374	3.132466	4.987681	0.0000
R-squared	0.980212	Durbin-Watson stat		1.776059
Adjusted R-squared	0.979159	Prob(F-statistic)		0.000000

Seeds are one of the factors of production that play a role in increasing rice production. Production will be successful when using superior seeds and in sufficient quantities. The results showed that the seed had significant effect to rice production and negative correlation. Negative correlations caused of the capacity of the land used is not in accordance with the seeds planted. The average use of seeds in Sengah Temila District is 35.1 kg / ha. According to Indah et al. (2015), the use of recommended seeds is 20-25 kg/ha. Meanwhile, according Bahasoan (2013), the number of recommended seeds is 30 kg / ha. The results of this study were in line with the results of research Suzana et al. (2011) where the land size affects rice production. In addition other research

results also show the same results as research by Hasrani and Tangkesalu (2013), Suharyanto (2013) and Bahasoan (2013).

In addition to land and seeds, fertilizer is also a factor of production that is just as important. Fertilizer is needed as a vitamin nutrient for optimal growth and development. Based on the results of research indicates that fertilizer had no significant effect to rice production and positive correlation caused by the use of fertilizers which were not in accordance with the needs of the plant.

The fertilizer used should be in accordance with the recommendation so that the maximum produced production. The use of fertilizer in the research area is 252.70 kg/ha. According to Mitalom (2016), to maximize the production amount of fertilizer used is 300 kg for urea fertilizer, 100kg for phosphorus fertilizer and 100 kg for potassium fertilizer per hectare of rice field crop. Meanwhile, according to Indah et al. (2015), the recommended use of fertilizer in rice farming is urea fertilizer 300 kg/ha, NPK 250 kg/ha fertilizer, and SP36 125 kg/ha. The results of this study were in line with research Dewi et al. (2012) who studied paddy rice in Subak Pacung Babakan Village, Mengwi District, Badung Regency, where fertilizer does not significantly affect the rice production.

Pesticides are needed by plants to prevent and eradicate pests and diseases. The results showed that pesticide had significant effect to rice production and negative correlation. Mistakes that often occur in the use of pesticides is spraying pesticides when the rice has been attacked by pests. This causes the production is not optimal. The results of this study were in line with the results of research Suharyanto (2013) in which pesticides have a significant effect on rice production.

Labor is a vital production factor because without labor production activities will not work. The results showed that labor had significant effect to rice production and positive correlation. The results of this study were in line with the research of Suzana et al. (2011) where labor has a significant effect on rice production. In addition the same research results also obtained Khai and Yabe (2011), Koirara et al. (2014) and Bahasoan (2013) where labor has a significant effect on rice production.

Efficiency

Efficiency is the ratio of output to input. According Farel and Timmer in Sucihatiningsih (2013: 8), stated that the efficiency can be divided into three namely technical efficiency, price (allocative) and economic.

1. Technical Efficiency

Based on the result of technical efficiency calculation with software Stochastic Frontier Production Function Version 4.1c it is obtained that technical efficiency of rice production in Sengah Temila district equal to 0.9554.

Table 3. Technical Efficiency base on Land Area in Sengah Temila District

No.	Land Area (Ha)	Frequency	Coefficeint
1	0.3	14	0.9548
2	0.4	29	0.9461
3	0.5	37	0.9684
4	0.6	20	0.9522
Mean			0.9554

The coefficient shown that rice production was not efficient because of the coefficient is more than 1. Nevertheless technical efficiency was almost efficient. This indicates that it was necessary to change inputs in order to achieve technical efficiency. Technical inefficiency occurs because of the use of inappropriate inputs, especially the use of fertilizer that was less than it should be and the use of seeds that exceed the capacity of the land.

2. Allocative Efficiency

The allocative efficiency is a state when the marginal product is equal to the factor price of production used.

Table 4. Allocative Efficiency

No.	Input	NPM
1	Land area	1.4227
2	Seed	68.6717
3	Fertilizer	9.5422
4	Drug	15.1369
5	Labor	1.4375
Allocative efficiency		19.2422

The allocative efficiency is 19.2422. This shown that the use of inputs in rice farming in Sengah Temila district was not efficient in price because the coefficient of price efficiency is more than 1. Allocative inefficiency caused by high input costs such as fertilizer and labor. The price of fertilizer in Sengah Temila district ranges from Rp450.000,00 per sack or Rp9.000,00 per kilogram. The production cost for fertilizer was very high at 25.31% while according to BPS (2015) the average production cost for fertilizer was only 10.40%. The cost of pesticide input was 5.44%. The figure was categorized high because the average cost of national rice pesticides was only 1.90% (BPS, 2015). From the difference in the cost of pesticides it was clear that the cost of production for pesticides was very large. While labor cost input expressed very high that is 62.43% because according to BPS (2015) labor cost that was 35.90%. The high cost of labor caused by ineffective labor due to the lack of knowledge of good farming practices whereas the labor wage was only Rp. 70.000, - per HOK.

3. Economic efficiency

Economic efficiency is the result of a combination of technical efficiency and price efficiency. Based on the result of economic efficiency is 18.3840. This shown that economically wetland rice agriculture in Sengah Temila district Landak regency was inefficient because the coefficient of economic efficiency is more than 1. This was due to technical efficiency and allocative that were not achieved so that economic efficiency is certainly not achieved.

Income

Farmer' income is the profit earned by farmers from the production which is reduced by the cost of using the factors of production. Production of rice from 100 farmers sampled in Sengah Temila District is 271,300 kg. The price of paddy is Rp4,500.00/kg. While the fixed cost of land rent is Rp92,600,000.00 and variable cost consists of seed cost Rp16,270,000.00, fertilizer cost Rp105,300,000.00, pesticide cost Rp36,240,000.00 and labor cost equal to Rp416,080,000.00. Based on the calculation result, the income of farmer is Rp554,360,000.00 or Rp5,543,600.00 per farmer in 4 months or Rp1,385,900.00 per farmer household per month. The income of farmer was low even lower than UMR of Landak regency in 2017 that is Rp 2.000.920,00. Low farmer income caused by high production cost of fertilizers, pesticides and labor.

CONCLUSIONS

Production of rice in Sengah Temila District Landak Regency was quite good with production of 5819 kg/ha. The factors that have a significant effect on rice production ware land, seeds, pesticides and labor whereas fertilizer factor had no significant effect. Land area was the factor that has the most dominant influence on rice production. Wetland rice farming in Sengah Temila District Landak Regency was declared inefficient both technically, price and economy. While the income of farmers was Rp1.385.900,00 per farmer household per month. Farmers' income was lower than the regional minimum wage (UMR) of Landak Regency in 2017 of Rp2.000.920.00. Suggested additional subsidized fertilizer and non-subsidized fertilizer price control and grain price by government.

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