Analysis Study of Mentik Wangi Cultivar's Effect on Technical, Allocative, and Economic Efficiency of Organic Rice Farming in Mojosongo District, Boyolali Regency, Indonesia

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ABSTRACT

This study is a qualitative and quantitative research that explored about mentik wangi cultivar rice production in organic rice farming system. Mentik wangi cultivar is a local rice seed originating from Magelang Regency, Central Java, which has an advantage in its distinctive aroma that smells naturally nice with a fluffier rice texture, so that it is much sought after by the people of Indonesia. This research aims to analyze the effect of mentik wangi cultivar rice production on technical, allocative and economic efficiency of organic rice farming. The observation was conducted in Dlingo Village, Mojosongo District, Boyolali Regency, Central Java Province, Indonesia. This study was conducted on 216 organic rice farmers as a sample from 521 farmers as a population during two planting seasons with a purposive sampling method. This research uses a stochastic frontier approach on production, cost production and profit function with cross section data. The results of this research are mentik wangi cultivar is the most dominant variable influencing production, production cost and profit efficiency compared to other varieties (IR64 and pandan wangi) with coefficient values of 0.0424, -0.0826, and 0.2159.

Keywords: *Indonesia, Mentik wangi cultivar, Agricultural management, Stochastic frontier, Local wisdom, Organic rice farming.*
JEL Classification:*C10; D24; M11; Q13.*

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Highlights of this paper

- This study is a qualitative and quantitative research that explored about mentik wangi cultivar rice production in organic rice farming system.
- This research aims to analyze the effect of mentik wangi cultivar rice production on technical, allocative and economic efficiency of organic rice farming.

1. INTRODUCTION

Indonesia is a vast archipelago with a large number of islands and a large population. Land in Indonesia is fertile soil with a variety of plants that can grow on it, including rice. Rice is the staple food of most of the population of Indonesia and also the Asian continent in general [1]. As the population grows in Indonesia, it is necessary to prepare the amount of food, especially rice. The supply of rice as a staple food is closely related to food security that must be endeavored so that the Indonesian people do not experience the danger of starvation, especially with the pandemic covid-19 that struck Indonesia and almost all countries in the world today.

To get healthy food that is free from harmful chemicals, it is necessary to try an organic farming system model. Organic farming systems as part of sustainable agriculture development synergize long-term agricultural goals in terms of ecological, economic and social aspects. Sudrajat [2] stated that organic agriculture in Indonesia emerged after the implementation of the green revolution in the 1970s that put forward agricultural technology by using chemical fertilizers and pesticides to cultivate the land and expecting abundant harvests with the intensification and extensification program of agriculture. Despite having delivered Indonesia as a food self-sufficient country in 1984, it cannot guarantee its sustainability. The green revolution program was instead felt to have a prolonged negative impact, which was detrimental to farmers.

Impacts arising from the green revolution program include a decline in the quality of soil fertility and the emergence of environmental damage problems, including the agricultural environment as a result of human activities. There are three main impacts caused by human activities that among the environmental problems existing, i.e.: (1) effects of the use of production inputs on the production of agriculture and the environment; (2) effects of the farming system on the emission of greenhouse gases; (3) effects of industrial activities and urban expansion in agricultural land. The use of the means of production inputs in modern agriculture, such as fertilizer and chemical pesticides has big impacts on the degradation of environmental quality in agriculture. Modern agriculture which was rolled out as green revolution has strong correlation with the environmental issues [3].

Nowadays, Indonesian people's awareness is starting to emerge by consuming organic healthy food that is free from harmful chemicals. The high demand for organic rice can be seen from people's lifestyles that are more concerned with human health and the environment for present and future generations [4]. Along with the increasing demand for organic rice, making farmers begin to switch from conventional agriculture that uses fertilizers and chemical pesticides to organic farming that uses organic fertilizers and pesticides that do not cause harmful effects on the environment. One element in organic farming systems is the use of local seeds (for example: mentik wangi, pandan wangi, rojolele, cianjur, etc) and not genetically modified seeds that require the intake of chemicals that are harmful to the soil. One of the local rice seeds used in this study was mentikwangi. Mentik wangi rice seed is one of the local rice varieties (*Oryza Sativa* L.) that need to be preserved and extracted for its potential. This rice seed comes from Magelang Regency, Central Java, Indonesia. The mentik wangi rice has the advantage of having a distinctive aroma that is the natural fragrance and fluffier rice texture, so that most Indonesians are interested in consumption. Mentik wangi rice has a weakness, namely the harvest age of about 125 days (4 months) so that farmers are less interested in planting because it exceeds the average harvest age of rice which is around 3 months. In addition, the weakness of mentikwangi is found in the level of collapse, which is easy to collapse [5].

To preserve local wisdom by improving the quality of local rice seeds such as mentik wangi cultivar, it is necessary to pay attention to productivity and efficiency in organic rice farming. Rutkauskas and Paulavičienė [6] states that productivity is the result of each unit of land, labor, capital (for example: livestock, money), time or other inputs (for example: energy, water, and nutrients). People in general, outside the farming family tend to measure the productivity of farming according to the total biomass yield, the yield of certain components (grain, straw, protein content) or yield by maximizing yield per unit of land. Efficiency is a relative concept measured by comparing the actual ratio of output to input to the ratio of output to input under optimal conditions. Efficiency is used to measure the economic performance of a company or farm. Farrell [7] explains the meaning of efficiency as the ability of a company or farm to produce maximum output with the use of a certain number of inputs.

Farrell [7]; Coelli, et al. [8] states that efficiency is classified into three, namely technical efficiency (TE), allocative efficiency (AE), and economic efficiency (EE). Technical efficiency shows the ability of farming to obtain maximum output from a certain number of inputs or in other words, technical efficiency is used to measure the amount of production that can be achieved at a certain level of input. This technical efficiency is related to the ability of farmers to use inputs to produce certain outputs at certain technological levels to produce on the isoquant frontier curve. Allocative efficiency is the ability of farmers to use inputs at optimal proportions at fixed factor prices and production technology. Allocative efficiency shows the relative ability of a farm to use a number of inputs to produce output under conditions of minimal cost or maximum profit at a certain technological level. This efficiency can be used to measure the level of rationality of farmers as economic people who seek maximum profit by comparing marginal products with comparison of input and output prices. Yotopoulos and Nugent [9] stated that the merging of technical efficiency (TE) and allocative efficiency (AE) would be economic efficiency (EE). Economic efficiency is understood as the ability possessed by farmers in producing to produce a predetermined number of outputs. In other words economic efficiency is the ability to produce technically efficient output with minimum costs. This means that the products produced, both technically and allocatively, are efficient. It can be said to be economically efficient because the combination of input-output will be in the frontier production function and the business development path.

This research is a scientific research that observes local rice seed varieties in the framework of organic agriculture in terms of economic, social and environmental aspects. This study aims to analyze the effect of the production of mentik wangi rice used as a dummy (in addition to IR64 and pandan wangi cultivars) on the technical, allocative and economic efficiency of organic rice farming in Dlingo Village, Mojosongo District, Boyolali Regency, Central Java Province, Indonesia. This research uses a stochastic frontier analysis approach in the production, production cost, and profit function using a number of production input variables, namely: land area, organic rice seeds, solid organic fertilizer, liquid organic fertilizer, liquid organic pesticide, solid organic pesticide, non-family labors, family labors, tractor's rental fee and cultivars.

2. LITERATURE REVIEW

Study of technical, allocative and economic efficiency was originally viewed on the Cobb-Douglas production function. Cobb-Douglas production function is a particular functional form of the production function, widely used to represent the technological relationship between the amounts of two or more inputs, particularly physical capital and labor, and the amount of output that can be produced by those inputs. Sometimes the term has a more restricted meaning, requiring that the function display constant returns to scale [10]. Cobb-Douglas production function was developed with stochastic frontier approach. This approach as it appears in the current literature was originally developed by Aigner, et al. [11]. Many varieties of the stochastic frontier model have appeared in the literature. A major survey that presents an extensive catalog of these formulations was initiated by Greene [12]; Bauer [13]; Kumbhakar and Lovell [14].

Today more technical efficiency studies are related to conventional rice. However, there are some researchers who examined the technical efficiency of organic rice with a stochastic frontier approach, such as in research Khairizal and Amin [15]; Murniati, et al. [16]; Riyardi, et al. [17]; Narendar, et al. [18]; Hidayati, et al. [19]; Sudrajat [20]. In addition to technical efficiency, there are also studies allocative efficiency of organic and conventional rice using a stochastic frontier approach, such as that conducted by Ghosh and Raychaudhuri [21]; Ouedraogo [22]; Ajoma, et al. [23]; Rathnayake and Amaratunge [24]; Arifin, et al. [25]; Sudrajat, et al. [26]. In addition to technical efficiency or allocative efficiency, there are also studies economic efficiency of organic and conventional rice using a stochastic frontier approach, as conducted by Adamu and Bakari [27]; Kaka, et al. [28]; Khoy, et al. [29]; Chang, et al. [30]; Dang [31]; Sudrajat, et al. [32]; Froehlich, et al. [33]. In addition to technical, allocative, or economic efficiency, there are also several agricultural studies that discuss farmer's behavior on facing production risk, both organic and conventional rice, as conducted by Prastanti [34]; Suharyanto, et al. [35]; Asbullah, et al. [36]; Hasanah, et al. [37]; Bola and Prihtanti [38]; Darwanto and Waluyati [39]; Sudrajat [40].

Technical, allocative and economic efficiency studies with a stochastic frontir approach that uses local seeds such as mentik wangi rice cultivar as a dummy in their research are still very rare. Most researchers observed mentik wangi rice cultivar related to growth, productivity, or even related to their resistance to disease. Yulianto [41] conducted a study on the resistance of mentikwangi rice varieties to blast disease in Central Java. Kristamtini, et al. [42]; Kurwasit [43]; Isnawan, et al. [44] observed mentik wangi rice cultivar in the SRI (System of Rice Intensification) planting pattern conducted in Suseno [45] conducted a research study on local seed varieties such as mentik wangi rice related to production costs, productivity, profits and marketing performance in Klepu Village and Sukorejo Village, Central Java, Indonesia.

3. DATA AND METHODOLOGY

3.1. Data Collection and Determination of Research Place

This research is a qualitative and quantitative research supported by primary and secondary data through in-depth interviews with existing farmers and stakeholders. Primary data collection is carried out to capture the characteristics of farm households, land tenure structures, farm household income structures, organic rice farming inputs and socio-economic factors that affect the efficiency of organic rice farming, while secondary data collection includes data from Central Bureau of Statistics (BPS) on growth Indonesian population and rice production and growth data. Besides that, it is also equipped with description data of Boyolali Regency and its districts which are related to the development of land area, productivity, farmer groups, agricultural management, etc.

This research was conducted in Boyolali Regency, Central Java Province, Indonesia, which included five districts (Andong, Nagasari, Sambi, Simo and Mojosongo) and seven villages (Catur, Jatisari, Dlingo, Metuk, Andong, Wates and Glonggong). From five districts, four are rain-fed agriculture (Districts: Andong, Nogosari, Sambi and Simo) and one other district is irrigated agriculture, Mojosongo District. In this study, one district was selected, namely Mojosongo District which is an irrigated organic agriculture with water sources from the spring above, so that all farmers really do organic rice farming. The organic rice farming land which is cultivated occupies a specific location separate from the conventional rice cultivation location (one stretch of organic rice) located in Dlingo Village, Mojosongo District.

Boyolali Regency is known as a rice-producing area including organic rice. Based on data from the Boyolali Organic Rice Farmers Association (Appoli) in 2014, organic rice farmers were divided into rice farmers who transitioned to organic rice, known as ICS and nationally certified farmers. The number of certified farmers is 521 farmers who are also the study population, spread in five districts, namely Sambi District (Catur Village: 72 farmers and Jatisari Village: 60 farmers), Mojosongo District (Dlingo Village: 151 farmers and Metuk Village: 56 farmers), Andong District (Andong Village: 79 farmers), Simo District (Wates Village: 13 farmers), and Nogosari District (Glonggong Village as many as 30 farmers). From 521 organic rice farmer population, 216 organic rice farmers were taken as samples with purposive sampling method.

3.2. Data Analysis

3.2.1. Data of Production Function

Aigner, et al. [11]; Meeusen and van Den Broeck [46]; Jondrow, et al. [47]; Coelli [48] suggested that stochastic frontier function is an extension of the original deterministic models to measure the unpredictable effects in the production limits. In this research, technical efficiency's data was analyzed with stochastic frontier production function (with cross section data) and then was estimated with Maximum Likelihood Estimation (MLE). MLE requires a particular assumption about the distribution of disturbance. There is a large class of disturbance distributions which may be specified which make the maximum likelihood frontier estimator regular and well behaved.The estimation of production function has been one of the more popular areas of applied econometrics Greene [12]. Recent work in duality theory which has linked production and cost functions has made this topic even more attractive. Stochastic frontier production function is an original deterministic model to measure the unpredictable effects (stochastic frontier) in the production limits. Stochastic frontier production function is formulated in Equation 1 as follows:

$$Y = \alpha_0 + \alpha_i X_i + \dots + \alpha_k X_k + (v_i - u_i),\ i = 1,\dots,N \qquad (1)$$

where:

Y = organic rice production in natural logarithm (ln).

X_i = number of inputs used in production process in natural logarithm (ln).

α_0 = constant.

α_{i-k} = estimated parameter.

v_i = error factors caused by factors beyond the farmers' control.

u_i = error factors caused by factors under the farmers' control.

Stochastic frontier production function was assumed to have the form of Cobb-Douglas production function that transformed into natural logarithm (ln) by including the effects of determinant factors of the level of technical inefficiency, so that stochastic frontier production function can be written in Equation 2:

$$\ln Y = \alpha_0 + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 + \alpha_3 \ln X_3 + \alpha_4 \ln X_4 + \alpha_5 \ln X_5 + \alpha_6 \ln X_6 + \alpha_7 \ln X_7 + \alpha_8 \ln X_8 + \alpha_9 \ln X_9 + \alpha_{10} D_1 + \alpha_{11} D_2 + \alpha_{12} D_3 + (v_i - u_i) \qquad (2)$$

where:

Y = number of grain production of organic rice (kg/ha/planting season).

X_1 = land area used by farmers (ha/planting season).

X_2 = number of organic rice seeds (kg/ha/planting season).

X_3 = amount of solid organic fertilizer (kg/ha/planting season).

X_4 = amount of liquid organic fertilizer (ltr/ha/planting season).

X_5 = amount of liquid organic pesticide (ltr/ha/planting season).

X_6 = amount of solid organic pesticide (kg/ha/planting season).

X_7 = wage of non-family labors (IDR/man days/planting season).

X_8 = wage of family labors (IDR/man days/planting season).

X_9 = tractor's rental fee (IDR/ha/planting season).

D_1 = dummy 1 (D_1 = 1; mentikwangi cultivar; D_1 = 0, other cultivars).

D_2 = dummy 2 (D_2 = 1; IR64 cultivar; D_2 = 0, other cultivars).

D_3 = dummy 3 (D_3 = 1; pandanwangi cultivar; D_3 = 0, other cultivars).

α_0 = constant.

$\alpha_{1,\dots,12}$ = coefficient of regression on production factors.

v_i = error factors caused by factors beyond the farmers' control.

u_i = error factors caused by factors under the farmers' control.

3.2.2 Data of Production Cost Function

To determine the effect of variables in organic rice farming on inefficiency of production cost in Mojosongo District, the stochastic frontir production cost function approach is used with cross section data and is estimated by the Maximum Likelihood Estimation (MLE) method. To determine the stochastic frontier production cost function can be done by changing the error specification from (vi - ui) to (vi + ui), so that the stochastic frontier production cost function in the form of the Cobb-Douglas function can be written in Equation 3 as follows:

$$C_i = X_i\beta + (v_i + u_i) \qquad ,i=1,\dots,N, \qquad (3)$$

where:

C_i = production cost of organic rice in natural logarithm (ln) .

X_i = input price normalized with output price in natural logarithm (ln).

β = parameter.

v_i = error factors caused by factors beyond the farmers' control.

u_i = error factors caused by factors under the farmers' control.

In cost function of organic rice farming system, factors estimated to affect the cost of production are the cost of land lease, the price of organic rice seed, the price of solid organic fertilizer, the price of liquid organic fertilizer, the price of liquid organic pesticides, the price of solid organic pesticides, the wage of labors, and the tractor's rental fee as well as the cost of cultivars used as dummy variables. By inserting these variables into the frontier equation, then the equation model of frontier production cost function estimator of organic rice farming can be written in Equation 4 below:

$$\ln C = \beta_0 + \beta_1\ln P_1 + \beta_2\ln P_2 + \beta_3\ln P_3 + \beta_4\ln P_4 + \beta_5\ln P_5 + \beta_6\ln P_6 + \beta_7\ln P_7 + \beta_8\ln P_8 + \beta_9 D_1 + \beta_{10} D_2 + \beta_{11} D_3 + (v_i + u_i) \qquad (4)$$

where:

C = production cost in organic rice farming (IDR/planting season) .

P_1 = cost of land lease (IDR/ha/planting season).

P_2 = cost of organic rice seeds (IDR/kg/planting season).

P_3 = cost of solid organic fertilizer (IDR/kg/planting season).

P_4 = cost of liquid organic fertilizer (IDR/ ltr/planting season).

P_5 = cost of liquid organic pesticide (IDR/ ltr/planting season).

P_6 = cost of solid organic pesticide (IDR/kg/planting season).

P_7 = wage of labors (IDR/man days/planting season).

P_8 = tractor's rental fee (IDR/ha/planting season).

D_1 = dummy 1 (D_1= 1for mentikwangicultivar; D_1= 0 for other cultivars).

D_2 = dummy 2 (D_2= 1 for IR64 cultivar; D_2= 0 for other cultivars).

D_3 = dummy 3 (D_3= 1 for pandanwangicultivar; D_3= 0 for other cultivars).

β_0 = constant.

$\beta_{1,..,11}$ = coefficient of regression on production cost factors.

v_i = error factors caused by factors beyond the farmers' control.

u_i = error factors caused by factors under the farmers' control.

3.2.3. Data of Profit Function

To determine the effect of variables in organic rice farming on profit inefficiency in Mojosongo District, a stochastic frontier profit function approach is used with cross section data and is estimated using the Maximum Likelihood Estimation (MLE) method. To determine the stochastic frontier profit function can be done by changing the error specification from (vi - ui) to (vi + ui), so that the stochastic frontier profit function in the form of the Cobb-Douglas function can be written in Equation 5 as follows:

$$\pi^* = \frac{\pi}{p} = G^*\left(W_1^*, W_2^*, \ldots, W_m^*; Z_1, Z_2, \ldots, Z_n\right) \text{- Exp } (v_i - u_i) \qquad ,i=1,\ldots,N \qquad (5)$$

where:

π^* = profit of organic rice farming system normalized in logaritma natural (ln).

p = output price.

G^* = coefficient of the use unfixed inputs normalized.

W_i = value of unfixed input normalized with output price.

Z_i = value of fixed input.

v_i = error factors caused by factors beyond the farmers' control.

u_i = error factors caused by factors under the farmers' control.

The stochastic frontier profit function is assumed to have the form of the Cobb-Douglas function which is transformed into a natural logarithmic form (ln). The stochastic frontier profit function can be formulated in Equation 6:

$$\ln\pi = \beta_0 + \beta_1\ln W_{ai} + \beta_2\ln W_{bi} + \beta_3\ln W_{ci} + \beta_4\ln W_{di} + \beta_5\ln W_{ei} + \beta_6\ln W_{fi} + \beta_7\ln W_{gi} + \beta_8\ln W_{hi} + \beta_9\ln W_{ii} + \beta_{10}D_1 + \beta_{11}D_2 + \beta_{12}D_3 + (v_i - u_i) \qquad (6)$$

where:

π = profit of organic farming system (IDR/ha/planting season).

W_{ai} = value of land lease (IDR/ha/planting season).

W_{bi} = value of organic rice seeds (IDR/ha/planting season).

W_{ci} = value of solid organic fertilizer (IDR/ha/planting season).

W_{di} = value of liquid organic fertilizer (IDR/ha/planting season).

W_{ei} = value of liquid organic pesticide (IDR/ha/planting season).

W_{fi} = value of solid organic pesticide (IDR/ha/planting season).

W_{gi} = wage of non-family labor (IDR/ha/planting season).

W_{hi} = wage of family labor (IDR/ha/planting season).

W_{ii} = tractor's rental fee (IDR/ha/planting season).

D_1 = dummy 1 (D_1= 1for mentikwangicultivar; D_1 = 0 for other cultivars).

D_2 = dummy 2 (D_2= 1 for IR64 cultivar; D_2= 0 for other cultivars).

D_3 = dummy 3 (D_3= 1 for pandanwangicultivar; D_3= 0 for other cultivars).

β_0 = constant.

$\beta_{1\dots12}$ = coefficient of the use unfixed inputs.

v_i = error factors caused by factors beyond the farmers' control.

u_i = error factors caused by factors under the farmers' control.

3.3. Hypothesis

Testing a hypothesis on the variables that influence the production inefficiency can be formulated as follows:

H_0:δ_i= 0 : *If t_{count}<t_{table}, then H_0 was accepted (H_1 rejected). It means that the variables did not influence the production inefficiency of organic rice farming in Mojosongo District, Boyolali, Indonesia.*

H_1:$\delta_i \neq 0$: *If t_{count}>t_{table}, then H_0 was rejected (H_1 accepted). It means that the variables influenced the production inefficiency of organic rice farming in Mojosongo District, Boyolali, Indonesia.*

Testing a hypothesis on the variables that influence the production cost inefficiency can be formulated as follows:

H_0:δ_i= 0 : *If t_{count}<t_{table}, then H_0 was accepted (H_1 rejected). It means that the variables did not influence the production cost inefficiency of organic rice farming in Mojosongo District, Boyolali, Indonesia.*

H_1:$\delta_i \neq 0$: *If t_{count}>t_{table}, then H_0 was rejected (H_1 accepted). It means that the variables influenced the production cost inefficiency of organic rice farming in Mojosongo District, Boyolali, Indonesia.*

Testing a hypothesis on the variables that influence the profit inefficiency can be formulated as follows:

H_0:δ_i= 0 : *If t_{count}<t_{table}, then H_0 was accepted (H_1 rejected). It means that the variables did not influence the profit inefficiency of organic rice farming in Mojosongo District, Boyolali, Indonesia.*

H_1:$\delta_i \neq 0$: *If t_{count}>t_{table}, then H_0 was rejected (H_1 accepted). It means that the variables influenced the profit inefficiency of organic rice farming in Mojosongo District, Boyolali, Indonesia.*

4. RESULTS AND DISCUSSION

4.1. Mentik Wangi Cultivar as a Dominant Factor on Stochastic Frontier Production Function

From the result of the research, the production of organic rice is determined by the use of the inputs such as land area, number of organic rice seeds, amount of solid organic fertilizer, amount of liquid organic fertilizer, amount of solid organic pesticide, amount of liquid organic pesticide, wage of non-family labors, wage of family labors, tractor's rental fee, and cultivars used. Analysis of the production function here illustrates the relation between production and its inputs in the research of the stochastic frontier production function. The results of the analysis are then estimated using the maximum likelihood estimation (MLE) method. From the variables suspected to affect the production of organic rice, variables that influenced the production significantly were land area, amount of liquid organic fertilizer, amount of solid organic pesticide, wage of family labors, tractor's rental fee, and cultivar used (mentik wangi). Variables including number of organic rice seeds, amount of solid organic fertilizer, amount of liquid organic pesticide and cultivar used (IR64) were not statistically significant.

Variables influencing positively, namely land area, amount of liquid organic fertilizer, wage of non-family labor, wage of family labors, tractor's rental fee, and mentik wangi cultivar illustrated that if those variables are increased at a certain level, they can increase the production of organic rice, while variables influencing negatively (amount of solid organic pesticides and pandan wangi cultivar) showed their over use by farmers, so it is necessary to reduce the use. From the variable that positively influences the stochastic frontier production function, it turns out that the tractor's rental fee variable is the most dominant variable influencing production efficiency with a coefficient value of 0.1486, followed by mentik wangi cultivar in second with a coefficient value 0.0424. Mentik wangi cultivar has the largest amount of productions compared to other varieties (IR64 and pandan wangi cultivars). It shows that if the tractor's performance and mentik wangi cultivar are improved, the production efficiency of organic rice farming system in Mojosongo District, Boyolali Regency will also increase. The estimation result of variables in stochastic frontier production function can be seen on Table 1:

Table-1. Estimation result of variables in stochastic frontier production function.

Variable	Parameter	Coefficient of regression	Standard error	t-ratio
Constant	α_0	152.3626	0.8001	9.276
Land area	α_1	0.0011*	0.0676	1.673
Number of organic rice seeds	α_2	-0.0897^{NS}	0.0738	-1.215
Amount of solid organic fertilizer	α_3	-0.0511^{NS}	0.0365	-1.400
Amount of liquid organic fertilizer	α_4	0.0132*	0.0081	1.691
Amount of liquid organic pesticide	α_5	0.0010^{NS}	0.0085	0.121
Amount of solid organic pesticide	α_6	-0.0489***	0.0104	-4.685
Wage of non-family labors	α_7	0.0115***	0.0031	3.703
Wage of family labors	α_8	0.0375***	0.0053	7.043
Tractor's rental fee	α_9	0.1486***	0.0690	2.153
Dummy 1	α_{10}	0.0424***	0.0069	6.125
Dummy 2	α_{11}	0.0709^{NS}	0.0560	1.267
Dummy 3	α_{12}	-0.0508***	0.0688	1.227
Sigma-square		0.6088	0.1929	3.156
Gamma		0.9877	0.0088	112.678
Log likelihood function		467.5480		
LR test of the one-sided error		152.3626		
Mean efficiency		0.5928		
Number of observations		216		
Source: Analysis of Primary Data 20				
Note:				
*** = significant at α=1%		t-table 1%	= 2,358	
** = significant at α=5%		t-table 5%	= 1,980	
* = significant at α=10%		t-table 10%	= 1,658	
NS = non significant at α=10%				

Source: Analysis of Primary Data 2016

4.2. Mentik Wangi Cultivar as a Dominant Factor on Stochastic Frontier Production Cost Function

Stochastic frontier production cost function of organic rice farming system is determined by the use of the cost of the inputs, such as cost of land lease, cost of organic rice seeds, cost of organic fertilizer (solid and liquid), cost of organic pesticide (solid and liquid), wage of labors, tractor's rental fee, and cost of cultivars used. Analysis of production cost function describes relation between production cost and inputs cost which is normalized with output price. In this research, production cost function with stochastic frontier Cobb-Douglas model and maximum likelihood estimation (MLE) as an estimator was used. All variables estimated to have an impact on production cost in organic rice farming system produce negative coefficient in accordance with the assumption of the stochastic frontier of production cost function. From the variables suspected to affect the production cost function, variables that influenced the production cost significantly were cost of land lease, cost of organic rice seeds, cost of solid organic fertilizer, wage of labors, tractor's rental fee, and cultivars used. Variables including cost of liquid organic fertilizer, cost of liquid organic pesticide and cost of solid organic pesticide were not statistically significant.

The variables that negatively influence the production cost of organic rice farming system are cost of the land lease, cost of organic rice seeds, cost of solid organic fertilizer, wage of labors, tractor's rental fee and cultivars used.

These variables must be suppressed in order to reduce the cost of the inputs. This is an implication of the variables in the inputs, in the production cost function. It shows that if the variables are raised at a certain level, the production cost of organic rice farming system will also increase. The cost of organic rice seeds variable is the most dominant variable influencing production cost efficiency with a coefficient value of -0.1811. Mentik wangi cultivar has the lowest value of production cost with a coefficient value of -0.0826 compared with other varieties (IR64 and pandan wangi cultivars). It indicates that if the use of organic rice seeds (including mentik wangi cultivar) is increased, it will reduce the production cost of organic rice farming in Mojosongo District, Boyolali Regency. The estimation result of variables in production cost function is shown on Table 2.

Table-2. Estimation result of variables in stochastic frontier production cost function.

Variable	Parameter	Coefficient of regression	Standard error	t-ratio
Constant	β_0	0.0572***	0.3992	14.324
Cost of land lease	β_1	-0.0631***	0.0260	-2.425
Cost of organic rice seeds	β_2	-0.1811***	0.0236	-7.690
Cost of solid organic fertilizer	β_3	-0.1785***	0.0207	-8.670
Cost of liquid organic fertilizer	β_4	-0.0004^{NS}	0.0025	-0.165
Cost of liquid organic pesticide	β_5	-0.0037^{NS}	0.0026	-1.430
Cost of solid organic pesticide	β_6	-0.0046^{NS}	0.0029	-1.532
Wage of labors	β_7	-0.1696***	0.0155	-10.971
Tractor's rental fee	β_8	-0.1807***	0.0288	-6.273
Dummy 1	β_9	-0.0826***	0.0321	-2.572
Dummy 2	β_{10}	-0.0627***	0.0263	-2.387
Dummy 3	β_{11}	-0.0471*	0.0274	-1.720
Sigma-square		0.2639***		
Gamma		0.9701***		
Log likelihood function		472.9363		
LR test of the one-sided error		374.3945		
Mean efficiency		0.4268		
Number of observations		216		

Source: Analysis of Primary Data 20
Note:

***	= significant at α=1%	t-table 1%	= 2,358
**	= significant at α=5%	t-table 5%	= 1,980
*	= significant at α=10%	t-table 10%	= 1,658
NS	= non significant at α=10%		

4.3. Mentik Wangi Cultivar as a Dominant Factor on Stochastic Frontier Profit Function

These things are the assumptions used in the model of stochastic frontier profit function. Farmer as a business manager will allocate their resources in accordance with the objectives to be achieved. The profits of organic rice farming system is determined by the value of land lease, the value of organic rice seeds, the value of solid organic fertilizer, the value of liquid organic fertilizer, the value of liquid organic pesticides, the value of solid organic pesticides, the value of non-family labor, the value of family labor, and the value of tractors rental fee and cultivars used. Analysis of organic rice farming profit function describes the relationship between profits with the value of the inputs used. This study used stochastic frontier profit function of Cobb-Douglas model with maximum likelihood estimation (MLE) as an estimator.

All variables suspected to affect the profit of organic rice farming system resulted in negative coefficients except dummy 1, dummy 2, dummy 3 and the value of land lease, so that they comply with the assumption of Cobb-Douglas profit function. From the variables suspected to the profit of organic rice farming system, four variables having significant and negative impacts were value of organic rice seeds, value of solid organic pesticides, value of family labor, and value of tractor's rental fee. While the value of land lease and cultivars used significantly and positively affected the profit of organic rice farming. The effects of value of solid organic fertilizer, value of liquid organic fertilizer, value of liquid organic pesticide, the value of non-family labor were not statistically significant to the profit function of organic rice farming system.

The variables negatively affecting the profit of organic rice farming system (value of organic rice seeds, value of solid organic pesticides, value of family labor, and value tractor's rental fee) illustrates that if these variables are increased at a certain level, then the profit function will decrease. While the value of land lease has positive effect with a coefficient value of 0.9407, which means that if the value of land lease is increased at a certain rate and other variables are in the steady state, the profit function of organic rice farming system will increase. Mentik wangi cultivar has the largest amount of profits with a coefficient value of 0.2159 compared to other varieties (IR64 and pandan wangi cultivars). The estimation result of variables of profit function is shown on Table 3.

Table-3. Estimation result of variables in stochastic frontier profit function.

Variable	Parameter	Coefficient of regression	Standard error	t-ratio
Constant	β_0	0.0925***	0.9574	9.657
Value of land lease	β_1	0.9407***	0.0377	24.973
Value of organic rice seeds	β_2	-0.0759***	0.0291	-2.609
Value of solid organic fertilizer	β_3	-0.0509^{NS}	0.0514	-0.989
Value of liquid organic fertilizer	β_4	-0.0308^{NS}	0.0251	-1.227
Value of liquid organic pesticide	β_5	-0.0352^{NS}	0.0249	-1.409
Value of solid organic pesticide	β_6	-0.1514***	0.0173	-8.773
Value of non-family labors	β_7	-0.0279^{NS}	0.0318	-0.881
Value of family labors	β_8	-0.0723**	0.0322	-2.246
Value of tractor's rental fee	β_9	-0.1672*	0.0091	-1.843
Dummy 1	β_{10}	0.2159***	0.0627	3.441
Dummy 2	β_{11}	0.1232	0.0176	7.006
Dummy 3	β_{12}	0.1436^{NS}	0.0897	1.601
Sigma-square		0.7776***	0.1619	4.802
Gamma		0.9999***	0.0003	38.380
Log likelihood function		410.3470		
LR test of the one-sided error		783.2011		
Mean efficiency		0.3782		
Number of observations		216		

Source: Analysis of Primary Data 20
Note:

***	= significant at α=1%	t-table 1%	= 2,358
**	= significant at α=5%	t-table 5%	= 1,980
*	= significant at α=10%	t-table 10%	= 1,658
NS	= non significant at α=10%		

4.4. The Importance of Agricultural Management on Increasing the Efficiency of Organic Rice Farming

Organic rice farming in Mojosongo District, Boyolali Regency still experiences technical, cost and profit inefficiencies. This is proven by the average value of technical efficiency, efficiency of production costs and profit efficiency of 0.5928; 0.4268 and 0.3782 see on Table 1, Table 2 and Table 3. In an effort to increase the efficiency of organic rice farming (technical, allocative and economic efficiency) good farm management is needed. One of the agricultural management referred to here is the use of quality local seeds such as mentik wangi cultivar which can increase production and profits and reduce production costs compared to other rice varieties (IR64 and pandan wangi cultivars) in the production function, costs and profits of stochastic frontiers. The use of mentik wangi rice seeds can improve technical efficiency, costs and profits in Mojosongo District, Boyolali Regency for several reasons, including: mentik wangi rice seeds are very suitable for the weather, soil conditions and irrigation in

Boyolali area, mentik wangi cultivar is a type of variety local rice which is resistant to pests and certain diseases, the maintenance of mentik wangi cultivar is quite easy, although it has a rather long life, and mentikwangi cultivar has a high selling value because of its distinctive natural nice smell and favored by many people for consumption.

Farm management in general can be interpreted as a science that studies the efficient use of factors of production or limited resources to achieve the desired goals. Farming management can organize precisely the factors of production, namely: land, labor, and capital, as well as the selection of various branches of farming such as plants, livestock, and fish aimed at generating maximum and continuous income in a farming unit. To run a good organic rice farming in Mojosongo District, Boyolali Regency requires proper agricultural management. The application of appropriate agricultural management can increase production efficiency, costs and profits. The management of organic rice farming in question includes: the use of superior local seeds, land management according to advice, good nursery maintenance, regular cropping arrangements, administration of organic fertilizers according to dosage, effective and efficient irrigation systems, pest control with organic pesticides, weed control is right up to the handling of the harvest process and postharvest properly. A description of good organic rice farming management in Mojosongo District, Boyolali Regency can be seen in Table 4:

Table-4. Description of the elements of organic rice farming system management.

No.	Description of farming system management	Farmer response	
		Yes	No
1	The seeds used are superior varieties	100.00	0.00
2	Using quality seeds and labeled	35.20	64.80
3	Conducting land perfectly as recommended	100.00	0.00
4	Take good care of the nursery	100.00	0.00
5	Population or planting arrangements are carried out regularly and appropriately as recommended	98.10	1.90
6	Providing organic fertilizer according to soil requirements	96.30	3.70
7	Irrigation of rice plants is carried out effectively and efficiently in accordance with soil conditions (intermittent irrigation)	99.10	0.90
8	Pest and disease control is carried out in an integrated and environmentally friendly manner	84.30	15.70
9	Weed control is carried out appropriately	97.20	2.80
10	Handling of the harvest and post-harvest process is done well	97.20	2.80

From the response of organic rice farmers (Table 4) it can be seen that all farmers (100%) use superior varieties of seeds, even though only a small portion of the seeds used are of high quality and labeled (35.20%). In addition, farmers also carry out perfect tillage as recommended (100%) and maintain nursery well (100%). Almost all (96.30%) farmers gave organic fertilizers according to the needs of the soil and 99.10% of the farmers gave water (irrigating) rice plants effectively and efficiently according to soil conditions (intermittent irrigation).

5. CONCLUSION

Organic rice farming system is becoming important because in addition to eco-friendly, indirectly it can be long-term alternative solution for the problem of rice production that will have an impact on the profit for the farmers, the environment and the next generation. Organic farming can preserve the local wisdom, including by using local rice seeds such as mentik wangi cultivar that environmentally friendly. This study aims to analyze the effect of mentik wangi cultivar rice production on the stochastic frontier production, cost and profit function on organic rice farming system in Dlingo Village, Mojosongo District, Boyolali Regency, Indonesia.

Mentik wangi cultivar is the most dominant variable influencing production, cost and profit efficiency compared to other varieties (IR64 and pandanwangi cultivars) with coefficient values of 0.0424; -0.1807; 0.2159.

Mentik wangi cultivar can improve the efficiency of organic rice farming in Mojosongo District, Boyolali Regency for several reasons, namely: mentik wangi rice seeds are very suitable to the weather, soil conditions and irrigation in Boyolali area, mentik wangi cultivar is a type of local rice varieties that are resistant to pests and certain diseases, maintenance of mentik wangi cultivar is quite easy, despite having a rather long life, and mentik wangi rice has a high selling value because of its distinctive natural nice smell and favored by many people for consumption.

Organic rice farming in Mojosongo District, Boyolali Regency still experiences technical, cost and profit inefficiencies. This is proven by the average value of technical, allocative, and economic efficiency of 0.5928; 0.4268 and 0.3782. To improve the efficiency of organic rice farming (technical, allocative and economic efficiency) good farming management is needed, which includes: the use of superior local seeds, land management according to recommendations, good nursery maintenance, regular cropping arrangements, administration of organic fertilizers according to dosage, an effective and efficient irrigation system, pest control with organic pesticides, proper weed control up to the handling of the harvest process and postharvest properly.

REFERENCES

[1] I. S. Sudrajat, "Role of farmer groups and field agricultural extension officer in the development of organic rice agricultural institutions in Boyolali Regency, Indonesia," *Journal of Biology, Agriculture and Healthcare*, vol. 10, pp. 33-40, 2020b. Available at: https://doi.org/10.7176/jbah/10-2-06.

[2] I. S. Sudrajat, "Correlation of the influence of management factor and farmer's behavior in technical efficiency and production risk: A case study on organic rice farming with environmental perspectives in Indonesia," *International Journal of Economics, Business and Management Studies*, vol. 7, pp. 27-44, 2020a. Available at: https://doi.org/ 10.20448/ 802.71.27.44.

[3] L. Irsal, K. Subagyono, and A. P. Setiyanto, "Issues and environmental management in agricultural revitalization," *Agricultural Research and Development Journal*, vol. 25, pp. 173-193, 2006.

[4] I. S. Sudrajat, "The influence of socioeconomic factors in the efficiency of organic rice farming in Boyolali Regency, Central Java Effect of socio-economic factors on efficiency of organic rice farming in Boyolali, Central Java," Unpublished PhD Thesis, Eleven March University of Surakarta, Indonesia, 2018.

[5] B. Abdullah, K. S. Prajitno, and R. Mudjisihono, *Performance of several rice genotypes towards improving rice quality performance of several rice genotypes towards improving rice quality*. Subang: Sukamandi Rice Research Center, 2006.

[6] J. Rutkauskas and E. Paulavičienė, "Concept of productivity in service sector," *Engineering Economics*, vol. 43, pp. 35-41, 2005.

[7] M. J. Farrell, "The measurement of productive efficiency," *Journal of the Royal Statistics Society*, vol. 120, pp. 253-290, 1957. Available at: https://doi.org/10.2307/2343100.

[8] T. J. Coelli, D. S. P. Rao, C. J. O'Donnell, and G. E. Battese, *An introduction to efficiency and productivity analysis*. London: Kluwer Academic Publishers, 1998.

[9] P. A. Yotopoulos and J. B. Nugent, *Economic of development emperial investigation*. New York: Harper & Row Publisher, 1976.

[10] E. F. Ulveling and L. B. Fletcher, "A cobb-douglas production function with variable returns to scale," *American Journal of Agricultural Economics*, vol. 52, pp. 322-326, 1970. Available at: https://doi.org/10.2307/1237508.

[11] D. J. Aigner, C. A. K. Lovell, and P. Schmidt, "Formulation and estimation of stochastic frontier production function model," *Journal of Econometrics*, vol. 6, pp. 21-37, 1977.

[12] W. H. Greene, "On the estimation of a flexible frontier production model," *Journal of Econometrics*, vol. 13, pp. 101-115, 1980. Available at: https://doi.org/10.1016/0304-4076(80)90045-7.

[13] P. W. Bauer, "Recent developments in the econometric estimation of frontiers," *Journal of Econometrics*, vol. 46, pp. 39-56, 1990. Available at: https://doi.org/10.1016/0304-4076(90)90046-v.

[14] S. C. Kumbhakar and C. A. K. Lovell, *Stochastic frontier analysis*. Cambridge: Cambridge University Press, 2000.

[15] Khairizal and A. M. Amin, "Efficiency analysis of production factors of rice farming SRI organic and inorganic in Kelayang Village, Rakit Kulim district, indragiri hulu regency," *Journal of Agricultural Dynamics*, vol. 29, pp. 271-282, 2014.

[16] K. Murniati, J. H. Mulyo, I. Irham, and S. Hartono, "Technical efficiency of organic rice farming in tanggamus regency lampung province," *Journal of Applied Agriculture Research*, vol. 14, pp. 31-38, 2014. Available at: http://dx.doi.org/10.25181/jppt.v14i1.139.

[17] A. Riyardi, A. L. Cahyani, and S. P. Prasetyo, "Analysis of technical inefisiensi of organic and in-organic rice farming in sub-regency of kebakkramat, regency of karanganyar based on production function stochastic frontier," in *The 6th University Research Colloquium 2017. Muhammadiyah University of Magelang*, 2017, pp. 531-539.

[18] A. Narendar, N. Hanani, and S. Syafrial, "Factors that influence technical efficiency of organic paddy farming in Sumber Ngepoh village, lawang district, malang regency," *Agricultural Socio-Economic Journal*, vol. 18, pp. 79-85, 2018. Available at: https://doi.org/10.21776/ub.agrise.2018.018.2.5.

[19] B. Hidayati, N. Yamamoto, and H. Kano, "Investigation of production efficiency and socio-economic factors of organic rice in sumber ngepoh district, Indonesia," *Journal of Central European Agriculture*, vol. 20, pp. 748-758, 2019. Available at: https://doi.org/10.5513/jcea01/20.2.2143.

[20] I. S. Sudrajat, "Effect of management factor on stochastic frontier production of organic rice farming in Indonesia," *Global Journal of Agricultural Research*, vol. 7, pp. 23-33, 2019a.

[21] C. Ghosh and A. Raychaudhuri, "Efficiency of rice production states in production and cost: Stochastic frontier analysis," *Artha Vijnana Journal of the Gokhale Institute of Politics and Economics*, vol. 57, pp. 255-275, 2015. Available at: https://doi.org/10.21648/arthavij/2015/v57/i4/111488.

[22] S. Ouedraogo, "Technical and economic efficiency of rice production on the irrigated plain of bagre (burkina faso): A stochastic frontier approach," *Journal of Economics and Sustainable Development*, vol. 6, pp. 78-85, 2015.

[23] C. Ajoma, J. A. C. Ezihe, and I. U. Odoemenem, "Allocative efficiency of rice production in cross river state, Nigeria: A production function approach," *IOSR Journal of Agriculture and Veterinary Science*, vol. 9, pp. 32-38, 2016. Available at: https://doi.org/10.9790/2380-0908023238.

[24] R. M. A. K. Rathnayake and S. P. P. Amaratunge, "An analysis of the technical and allocative efficiency of paddy farming: The case of Mahaweli system H. Srilanka," *Journal of Economic Research*, vol. 4, pp. 35-57, 2016.

[25] R. Arifin, A. A. Wahditiya, Nirawati, and M. A. Biba, "Efficiency and income of rice farming in rainfed lowland," *International Journal of Scientific & Technology Research*, vol. 7, pp. 52-55, 2018. Available at: https://www.researchgate.net/publication/325103194.

[26] I. S. Sudrajat, E. S. Rahayu, and K. Supriyadi, "Effect of institution on production cost efficiency of organic rice farming in Indonesia," *DLSU Business and Economics*, vol. 28, pp. 166-175, 2018.

[27] T. Adamu and U. M. Bakari, "Profit efficiency among rain-fed rice farmers in Northern Taraba State, Nigeria," *Journal of Biology, Agriculture and Healthcare*, vol. 5, pp. 113-119, 2015.

[28] Y. Kaka, M. N. Shamsudin, A. Radam, and I. A. Latif, "Profit efficiency among paddy farmers: A cobb-douglas stochastic frontier production function analysis," *Journal of Asian Scientific Research*, vol. 6, pp. 66-75, 2016. Available at: https://doi.org/10.18488/journal.2/2016.6.4/2.4.66.75.

[29] R. Khoy, T. Nanseki, and Y. Chomei, "Profit efficiency of rice farmers in Cambodia the differences between organic and conventional farming," *Journal of Sustainable Development*, vol. 9, pp. 34-45, 2016. Available at: https://doi.org/10.5539/jsd.v9n6p34.

[30] T. Chang, D. Takahashi, and C. K. Yang, "Profit efficiency analysis of rice production in Taiwan," *China Agricultural Economics Review*, vol. 9, pp. 32-47, 2017. Available at: https://doi.org/10.1108/CAER-04-2016-0059.

[31] N. H. Dang, "Profitability and profit efficiency of rice farming in Tra Vinh Province, Vietnam," *Review of Integrative Business and Economics Research*, vol. 6, pp. 191-201, 2017.

[32] I. S. Sudrajat, E. S. Rahayu, E. S. Kusnandar, and Supriyadi, "Effect of social factors in stochastic frontier profit of organic rice farming in Boyolali," *Bulgarian Journal of Agricultural Science* vol. 23, pp. 551-559, 2017.

[33] A. G. Froehlich, A. S. Melo, and B. Sampaio, "Comparing the profitability of organic and conventional production in family farming: Empirical evidence from Brazil," *Ecological Economics*, vol. 150, pp. 307-314, 2018. Available at: https://doi.org/10.1016/j.ecolecon.2018.04.022.

[34] G. D. Prastanti, "Analysis of farmer's behavior towards the risk of organic rice farming: A study in Prosperous Resources I farmer groups, Sumberngepoh Village, Lawang District, Malang Regency, East Java," Bachelor Thesis, Brawijaya University, Malang, 2014.

[35] S. Suharyanto, J. Rinaldy, and N. N. Arya, "Risk analysis of the production of rice farming in Bali Province," *Jurnal Agraris*, vol. 1, pp. 70-77, 2015. Available at: https://doi.org/10.18196/agr.1210.

[36] M. Asbullah, T. D. Hapsari, and S. Sudarko, "Analysis of income risk on organic rice farming in lombok kulon village, wonosari district, bondowoso regency," *Journal of Agricultural Social Economics*, vol. 10, pp. 35-42, 2017. Available at: https://doi.org/10.19184/jsep.v10i2.4552.

[37] J. Hasanah, M. Rondhi, and T. D. Hapsari, "Analysis of risk for USA organic rice production in rowosari village, Sumberjambe sub-district, Jember district," *Indonesian Agribusiness Journal*, vol. 6, pp. 37-48, 2018. Available at: https://doi.org/10.29244/jai.2018.6.1.23-34.

[38] E. Bola and T. M. Prihtanti, "Organic rice farmers' behavior towards risk in susukan district, semarang regency," *Journal of Agricultural Social Economics*, vol. 13, pp. 279-290, 2019. Available at: https://doi.org/10.24843/SOCA.2019.v13.i02.p10.

[39] D. H. Darwanto and L. R. Waluyati, "Farmer's behavior towards lembah Palu shallot farm risks in central sulawesi, Indonesia," *EurAsian Journal of BioSciences*, vol. 13, pp. 931-936, 2019.

[40] I. S. Sudrajat, "Farmer behavior on facing production risk of organic rice farming in Indonesia," *Journal of Economics and Sustainable Development*, vol. 10, pp. 1-8, 2019b. Available at: https://doi.org/ 10.7176/JESD.

[41] Y. Yulianto, "The resistance of mentik wangi local rice varieties to blast disease," *Journal of Food System & Agribusiness*, vol. 1, pp. 47-54, 2017.

[42] Kristamtini, S. Widyayanti, and S. Rahayu, "Mentik wangi local rice's response to technology approach of SRI system of rice intensification) and integrated crop management," *Widyariset*, vol. 14, pp. 565-570, 2011.

[43] N. Kurwasit, "Study of irrigation techniques and local varieties on rice cultivation technology Oryza Sativa L. SRI system of rice intensification," presented at the Muhammadiyah University of Yogyakarta, Indonesia, Indonesia Results Paper Seminar, 2016.

[44] B. H. Isnawan, N. Kurwasit, G. Supangkat, and S. Ediyono, "Review of irrigation kinds and local variety in growth and rice product Oryza sativa L. SRI system of rice intensification method," *Saintis*, vol. 9, pp. 181-192, 2017.

[45] I. Suseno, "Comparative study of production costs, productivity, profits, marketing performance of organic rice with inorganic rice Klepu village and Sukorejo village, central Java," Bachelor of Thesis, Sanata Dharma University of Yogyakarta, Indonesia, 2016.

[46] W. Meeusen and J. van Den Broeck, "Efficiency estimation from cobb-douglas production functions with composed error," *International Economic Review*, vol. 18, pp. 435-444, 1977. Available at: https://doi.org/10.2307/2525757.

[47] J. Jondrow, C. K. Lovell, I. S. Materov, and P. Schmidt, "On the estimation of technical inefficiency in the stochastic frontier production function model," *Journal of Econometrics*, vol. 19, pp. 233-238, 1982. Available at: https://doi.org/10.1016/0304-4076(82)90004-5.

[48] T. J. Coelli, "A guide to frontier version 4.1. A computer program for stochastic frontier production and cost function estimation," CEPA Working Papers No. 7/96. Armidale: Department of Econometrics, University of New England1996.