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EFFECT OF SOCIAL FACTORS IN STOCHASTIC FRONTIER PROFIT OF ORGANIC RICE FARMING IN BOYOLALI

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Abstract

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This research explored about the profit of organic rice farming system that influenced by social factors with stochastic frontier Cobb-Douglas profit function and MLE (Maximum Likelihood Estimation). The observation was made at farmer groups namely *Pangudi Raharjo* and *Pangudi Boga* in Dlingo Village, Mojosongo, Boyolali, Central Java, Indonesia. Stochastic frontier method is equation model to estimate the parameters of the factors that will affect the level of profit efficiency in order to be close to the maximum (frontier). In this model, the factors that affecting the profitability and the factors causing the profit inefficiency of organic rice farming can be seen. This model was called composed error model because the error term consists of two components, namely the external factor/ errors caused by factors that can't be controlled by the farmers (V_1) and internal/ errors caused by factor that can be controlled by the farmers (U_1). Error due to internal factors (U_1) is composed of economic and social factors. This study elaborated the effects of social factors on inefficiency in the profit of organic rice farming system. As the result, the most dominant social factor was management which followed by frequency of participation in training, the role of institutions/ associations, frequency of participation in counseling, and the age of the farmers.

Key words: Boyolali; management; maximum likelihood estimation; organic farming; profit function

Introduction

Problems related with water, soil, air, plants, and animals are becoming vital environmental issues. Stockholm Declaration (Sohn, 1973) emphasized human responsibility to protect environment and natural resources including soil, water, air, plants, and animals for the sake of both present and future generation.

Agriculture is a sector processed and managed by human which leads to big impact on the environment. Norse and Tschirley (2003) and Las et al. (2006) explained that among the environmental problems existing, there are three main impacts caused by human activities, 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 to trigger production 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.

According to Manning (1988) and Widodo (1988), green revolution is the process of more agricultural transformation from traditional to use of modern inputs together with the complementary technology. Green revolution was initially able to bring Indonesia to rice self-sufficiency in 1984. After

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1984, green revolution was unable to significantly increase rice production. It brought negative impact instead, especially on soil fertility and its ability to produce food with sufficient quality and quantity.

Organic agriculture becomes vital because indirectly it can be long-term alternative solution for the problems of rice production through natural recycling system to increase the productivity of the soil. Sutanto (2002a) explained that on the basic principles of developing soil fertility is by processing organic matters. The organic matters processing is then applied in organic rice farming. According to Rigby and Caceres (2001), organic farming is sustainable agriculture. The sustainability framework for agriculture and food production consist of a trilogy of equally important and mutually interacting and reinforcing objectives for social, economic and environmental sustainability. Organic rice farming system is an eco-friendly farming system. FAO (Food and Agriculture Organization) described that organic farming system is designed to improve biological activities of soil, maintain long-term soil fertility, promote the health use of soil, water and air, and minimize polution resulted from agriculture.

Besides giving better effects to the health of the environment, the benefit of organic rice farming system is on the products. Rice produced from organic farming becomes healthy food since it is free from residual of chemical fertilizer and pesticide. Sutanto (2002b) stated that organic farming helps people supply agricultural products which are free from chemical residue in order to improve the public health, besides, the organic rice farming system is expected to be efficient. By being efficient, the farmer's income can be increased and the final goal, the farmer's health can be achieved. Thus, it can be inferred that organic farming gives important contribution to human's health through the food production to farmers' wealth through the income and to the planet's health through its eco-friendly activities.

Study on the economical efficiency was initially observed from production function of Cobb-Douglas which was then developed using stochastic frontier approach. Research about efficiency of organic rice farming system using stochastic frontier approach is still limited compared to those of conventional rice farming system, especially about the efficiency of production cost in organic rice farming system using stochastic frontier. Previous researches mostly used production function of stochastic frontier, like those conducted by Jondrow et al. (1982), Battese and Coelli (1988, 1992, 1993 dan 1995), Galawat and Mitsuyasu (2012a), and Suharyanto et al. (2013) who observed efficiency using production function of stochastic frontier. Rahman (2003), Kolawole (2006), Karafillis and Papanagiotou (2009), Galawat and Mitsuyasu (2012b) and Mailena et al. (2014) analyzed the efficiency using profit function of stochastic frontier. In addition, Irawan et al. (2004) and Hermanto (2010) mentioned that the productivity of rice in organic farming system will decrease during initial steps, even until three or four the growing season. After that, the productivity of rice in organic farming system will increase and reach normal stage even higher than in conventional farming system.

In stochastic frontier, there are some error factors caused by the factors that can't be controlled by farmers and those caused by the factors that can be controlled by farmers. This research used error factors caused by factors that can be controlled by farmers. Some factors commonly used are farmers' age, level of formal education, farming period, and number of family members. While factors newly used are frequency of participation in counseling, frequency of participation in training or courses, the role of farmer groups and counselors, the role of institutions, and farm management.

The fundamental problem in organic rice farming system is on the efficiency of the system, even today, the problem of organic rice farming system is the production and costs of production vary among farmers leading to difference in production cost and productivity which then affects the farmers' income. The income of the farmers from organic rice is varies because the price of organic rice that received also vary. The use of organic production factors is expected to be able to suppress the cost of organic rice production which then increases the profit. Inefficient use of production factors in organic rice farming system in Boyolali is one of the factors causing high production cost resulting in low income. In fact, one of the goals of farmers to manage the farming is to make profit. Therefore, the farmers as business managers will allocate their resources in accordance with the objectives to be achieved.

The allocation of these resources is closely related to the level of profits to be achieved. The amount of revenue gained will be strongly determined by the results of the sales value and production costs incurred. Maximum profit will be achieved if all factors of the production have been allocated to use optimally and efficiently, both technically, in prices, and in the economy. It means that farmers must be optimal in the use of production inputs in order to achieve a high productivity as well as to maintain cost efficiency. Maximum profit in the short term can be achieved in conditions where the marginal productivity value of output is equal to its marginal cost or input prices.

Agricultural institution is a custom that organized and applied continuously to meet the needs of the society which are closely related to the livelihood of agriculture in rural area. In the life of farmer's community, the position and function of farmer institution is a part of social institutions that facilitate social interaction in a community. In addition, the farmer institution also has a strategic point in moving the agricultural system in the rural area. Institutional role in establishing and developing the agricultural sector in Indonesia is particularly noticeable in the activities of food crops, especially organic rice farming system.

Organic rice farming system, as a new type of farming system, needs different management from conventional farming system. Management of farming system is the ability of the farmer to decide, organize, and coordinate production factors as well as to produce expected agriculture products. Hence, management as one of the social facstors is expected to improve the profit function in organic rice farming system. Based on the explanation, this research aims to analyze the effect of social factors in the stochastic frontier profit on organic rice farming in Boyolali, Central Java, Indonesia as seen in the Figure 1 below:

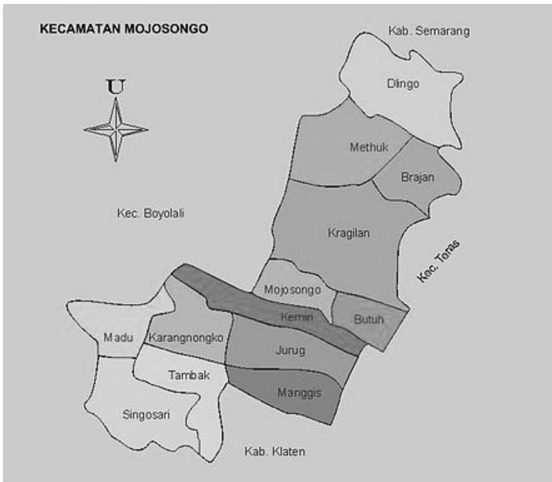

Figure 1. Map of Mojosongo District

Theoretical Approaches

The approach used in this research was Cobb-Douglas profit function. According to Yotopoulus and Nugent (1976) and Ghee-Thean et al. (2012) this model is considered to have several advantages compared to the production function and linear programming, including: (i) the function of output supply and that of input demand can be presumed together without having to create a production function explicitly, (ii) profit function can be used to assess the efficiency of technical, price, and economy, and (iii) in the profit function models, variables measured are variables of output and input prices.

Yotopoulus and Nugent (1976) mentioned generally the function of profits can be explained through mathematical reduction process by the production function as follows:

$$Y = f(X_1, X_2, \ldots, X_m; Z_1, Z_2, \ldots, Z_n) \quad (1)$$

$$p = pf(X_1, X_2, \ldots, X_m; Z_1, Z_2, \ldots, Z_n) \quad (2)$$

where:

π = short term profit
p = output price per unit
Xi = the i^{th} unfixed input (i=1,2,...,m)
Zj = the j^{th} fixed input (j=1,2,...,n)
Wi = the price of the i^{th} unfixed input

According to Doll and Orazeem (1978), maximum profit is gained when the value of marginal production is equal to input price, therefore mathematically, the formula can be written as follows:

$$p = \frac{\partial .f(X_1, X_2, ..., X_m; Z_1, Z_2,..., Z_n)}{\partial X_i} = W_i \quad (3)$$

If equation (1) is normalized with output price, the following equation is obtained:

$$p = \frac{\partial .f(X_1, X_2, ..., X_m; Z_1, Z_2,..., Z_n)}{\partial X_i} = W_i^* \quad (4)$$

where $W_i^* = W_i/p$ = the price of the i^{th} input normalized with output price. If equation (2) is normalized with output price, there will be new equation as follows:

$$\pi^* = \frac{\pi}{p} = f(X_1, X_2, ..., X_m; Z_1, Z_2,..., Z_n) - \sum_{i=1}^{m} W_i^*.X_i^* \quad (5)$$

where p^* is known as a UOP (Unit Output Price) profit function. Optimal amount of input variables X_i contributing maximum short term profit can be derived from equation (2) that is:

$$X_i^* = f(W_1, W_2, \ldots, W_m; Z_1, Z_2, \ldots, Z_n) \quad (6)$$

Substitution of equation (4) into equation (2) will result in:

$$\pi = p.f(X_1, X_2, ..., X_m; Z_1, Z_2,..., Z_n) - \sum_{i=1}^{m} W_i^*.X_i^* \quad (7)$$

Since X_j^* acts as the function of W_i^* and J_z, thus equation (5) can be written as follows:

$$\pi = p.G^*(W_1^*, W_2^*, ..., W_m^*; Z_1, Z_2,..., Z_n) \quad (8)$$

Equation (6) is a function that provides the maximum benefit from short-term profit for each output prices, unfixed input prices of W_i and the level of fixed inputs of Z_j. If the equation (8) is normalized with the output price, then new equation will be obtained:

$$\pi^* = \frac{\pi}{p} = G^*(W_1^*, W_2^*, ..., W_m^*; Z_1, Z_2,..., Z_n) \quad (9)$$

Equation (9) is a Unit Output Price profit function as a function of unfixed input prices normalized with the output price and the number of fixed inputs.

To see the profit inefficiency of organic rice farming, the efficiency concept used is that proposed by Farrell (1957) and Coelli et al. (1998) which stated that efficiency is classified into three parts, namely: the technical efficiency, allocative efficiency (cost), and economic efficiency. Technical efficiency shows the ability of farming to obtain the maximum output from certain amount of total input. While allocative efficiency shows the relative ability of a farming system to use inputs to produce outputs on the condition of minimal cost or maximum profit at particular level of technology. The integration of those efficiencies would result in economic efficiency.

Aigner et al. (1977), Meeusen and van den Broeck (1977), Jondrow et al. (1982), and Coelli (1996), suggested that stochastic frontier function is an extension of the original deterministic models to measure the effects of unpredictable (stochastic frontier) in production limits. In this production function, random error (V_i) is added into a non-negative random variables (U_i). Random error (V_i) is useful to calculate the size of the error and other random factors such as the weather, and others together with the effect of the combination of input variables which is not defined in the production function. Variable V_i is a random variable that is independent and identically normal distributed with zero average and constant variance. Variable U_i is assumed as i exponential or half-normal random variable. If we want to determine the stochastic frontier profit function, we just change the specification of error of (V_i - U_i) to (V_i + U_i) so that the substitution will alter the production function to costs function as follows:

$$\pi^* = \frac{\pi}{p} = G^*(W_1^*, W_2^*, ..., W_m^*; Z_1, Z_2,..., Z_n) - \text{Exp}\,(V_i - U_i),\ i = 1,\ldots, N, \qquad (10)$$

where:

π^* = the profit of organic rice farming system normalized in natural logarithm

p = output price

β = coefficient of the use of unfixed input

W_i = the value of unfixed input normalized with output price

Z_i = the value of fixed input

V_i = error caused by factors that can't be controlled by farmers

U_i = error caused by factors that can be controlled by farmers

Materials and Methods

Determination of research place

Total number from the certified of organic farmers is 521 people spread over five districts, seven villages and ten farmers' groups. From the ten farmers' groups, two groups were chosen, namely *Pangudi Raharjo* and *Pangudi Boga* located in Dlingo Village, Mojosongo, Boyolali, Central Java, Indonesia. The reason to choose those groups are: (i) both groups are located in the same area, (ii) they have the same water source from soil water irrigation, (iii) they are separated from other farmer' groups, and (iv) they can carry out three planting seasons in a year.

Samples of Farmers

The number of *Pangudi Raharjo* and *Pangudi Boga*'s member is 55 and 96 people respectively, so the total number of farmers in both groups is 151 people. From the 151 farmers, 108 farmers are banded together since there were doubled names after the data were verified. Two planting seasons were used in this research resulting in the samples number of 216 people (2x108).

Data analysis

To determine the influence of the role of institution and managerial ability of the farmers in organic rice farming on the profit inefficiency of organic rice farming in Boyolali, stochastic frontier function of costs was applied and it was estimated by using MLE (Maximum Likelihood Estimation). According to Aigner et al. (1977), Meeusen and van den Broeck (1977) and Jondrow et al. (1982) the profit function of stochastic frontier is assumed to have a Cobb-Douglas which is transformed into natural logarithm (ln). Stochastic frontier profit function is defined as follows:

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

where:

π = the profit of organic rice farming system (rupiah/ha/planting season)

W_{ai} = the value of land lease (rupiah/ha/planting season)

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

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

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

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

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

W_{gi} = the value of non-family labor (rupiah/ha/planting season)

W_{hi} = the value of family labor (rupiah/ha/planting season)

W_{ii} = the value of tractors rental fee (rupiah/ha/planting season)

D_1 = Dummy-1 (D_1 = 1; for cv. *mentik wangi*; D_1 = 0, for other cultivars)

D_2 = Dummy-2 (D_2 = 1; for cv. IR64; D_2 = 0, for other cultivars)

D_3 = Dummy-3 (D_3 = 1; for cv. *pandan wangi*; D_3 = 0, for other cultivars)

β_0 = constant

$\beta_{1...12}$ = coefficient of the use unfixed inputs

V_i = error caused by factors that can't be controlled by farmers

U_i = error caused by factors that can be controlled by farmers

To see the effect of the determinants of the level of the profit inefficiency of organic rice farming system in Boyolali, the formula used was as follows:

$$U_i = TE_i = \delta_{0} + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_9 Z_9 + \delta_{10} Z_{10}$$

where:

U_i = effects of production cost inefficiency

Z_1 = farmers' age (years old)

Z_2 = formal education level of the farmers (years)

Z_3 = period of organic farming (years)

Z_4 = the number of family members of the farmer (people)

Z_5 = frequency of participation in extension (times)

Z_6 = frequency of participation in training (times)

Z_7 = course of organic farming (score)

Z_8 = the role of farmers group and agricultural counselors (score)

Z_9 = the role of institution (score)

Z_{10} = farming system management (score)

Result and Discussion

MLE estimation of the profit function in organic rice farming system

One of the farmers' goals in managing their farming system is to obtain the optimum profit. According to Nguyen Huu Dang (2017) to achieve the goal, the farmers face some obstacles (input and output prices). Goals to be achieved and the obstacles they face are the decisive factor for farmers to make decisions in their farming system. Efforts to reduce the production cost is something difficult to do because in general the farmers are able to buy the production factors, but not able to set the price of them. However, the farmer as a unit of economic analysis attempts to maximize profits, makes the purchase of inputs and sale of outputs in perfect competitive markets, or farmer as the recipient of the price (price taker), and the production function is concave shaped in the unfixed inputs.

These things are the assumptions used in the model of profit function. Farmer as business manager will allocate their resources in accordance with the objectives to be achieved. The profits of organice 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 model of Cobb-Douglas with MLE estimation. The results of MLE estimation of stochastic frontier profit function in organic rice farming system are shown in Table 1.

Table 1. MLE estimation of stochastic frontier profit function in organic rice farming system

Variable	Parameter	Coefficient of regression	Standard error	t-ratio
Constant	β0	0.0925***	0.9574	9.657
The value of land lease	β1	0.9407***	0.0377	24.973
The value of organic rice seeds	β2	-0.0759***	0.0291	-2.609
The value of solid organic fertilizer	β3	-0.0509NS	0.0514	-0.989
The value of liquid organic fertilizer	β4	-0.0308NS	0.0251	-1.227
The value of liquid organic pesticide	β5	-0.0352NS	0.0249	-1.409
The value of solid organic pesticide	β6	-0.1514***	0.0173	-8.773
The value of non-family labor	β7	-0.0279NS	0.0318	-0.881
The value of family labor	β8	-0.0723**	0.0322	-2.246
The value of tractors rental fee	β9	-0.1672*	0.0091	-1.843
Dummy 1	β10	0.2159***	0.0627	3.441
Dummy 2	β11	0.1232	0.0176	7.006
Dummy 3	β12	0.1436NS	0.0897	1.601

Source: primary data 2016

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 nine variables suspected to the profit of organic rice farming system, four variables having significant and negative impacts were the value of seed, the value of solid organic pesticides, the value of family labor, and the value of tractors rental fee. While the value of land lease significantly and positively affected the profit of organic rice farming. The effects of the value of solid organic fertilizer, the value of liquid organic fertilizer, the value of liquid organic pesticide, and the value of non-family labor were not statistically significant to the profit of organic rice farming.

The variables negatively affecting the profit of organic rice farming system (the value of seeds, the value of solid organic pesticides, the value of family labor, and the value tractors rental fee) illustrates that if these variables are increased at a certain level, then the profit will decrease. While the value of land lease has positive effect, which means that if the value of land lease is increased at a certain rate and other variables are in the steady state, the profits of organic rice farming system will increase. The organic rice farming system of cultivar *mentik wangi* had the largest amount of profits compared to other cultivars (IR64, *pandan wangi*, and *beras merah*).

The value of estimated parameters in the stochastic frontier profit function of organic rice farming system shows the elasticity of the profit from the value of inputs used. Coefficients in the profit function of Cobb-Douglas describe the elasticity of each input value and also describe the condition of return to scale. The coefficients number of the variables used is 0.4739. It shows that the profit of the organic rice farming system was in stage II (decreasing returns to scale), meaning that if all input values were added together on 1%, so the profits of the organic rice farming system increased on 0.4739%. Elasticity values of the frontier profit of the organic rice farming system from variable of the value of land lease (0.9407), the value of seed (-0.0759), the value of solid organic pesticides (-0.1514), the value of family labor (-0.0723), and the value of tractors rental fee (-0.1672) indicate that increasing the value of land lease, the value of seed, the value of solid organic pesticides, the value of family labor, and the value of tractors rental fee by 1% assuming that the costs of other inputs are in a state of *ceteris paribus* (fixed) will increase the profit of the farming system by 0.9407; -0.0759; -0.1514; -0.0723; and -0.1672.

The cause of profit inefficiencies in organic rice farming system

There are several factors estimated to be the cause of the inefficiency of the profits of organic rice farming system including: farmers' age, formal education level of the farmers, period of organic rice farming, the number of the farmer's family member, the frequency of participation in counseling, the frequency of participation in training, coaching or courses of organic rice farming, the role farmer groups and agricultural counselors, the role of institutions or associations, and management of farming system. From the estimation results (Table 2) can be seen the value of the log likelihood function with MLE method of 410.3470, that its value is more greater than the value of the log likelihood function by the method of OLS (Ordinary Least Squares) with the value of 249.5071. It indicates that the profit function of the organic rice farming system using MLE method is better than using the OLS, thus it is in accordance with the real conditions in the field. The value of sigma-square is 0.7776. It shows the distribution of the error term inefficiency (Ui) and the value is very big or in other words the value of $\sigma_u^2 > 0$ (if $\sigma_u^2 = 0$, it means that all farming system carried out by the farmers is 100% efficient). It is concluded that there is no evidence that not all farming system carried out by the farmers is 100% efficient. It indicates that the variation of the profits of organic rice farming that contributed by the inefficiency factor is 77.76%.

Table 2 shows the gamma value (g) is equal to 0.9999 and statistically, the estimated value of g in the model is significant at a = 1%, this shows that the variation of the profit of the organic rice farming system is about 99.99% as a result of inefficiencies (U_i) and the rest (0.01%) is due to the variables that are beyond the control or factors that can not be controlled by the farmers (V_i). It indicates that the use of Cobb-Douglas profit function is able to properly explain the existing data on the occurrence of the phenomenon of profit inefficiency in organic rice farming system used. The value of LR (Likelihood Ratio) restristic parameter test is 783.2011 which is greater than the critical value from Kodde and Palm table (1986) and significant at a = 1%. It means that there are inefficiencies in the stochastic model. This fact shows that organic rice farmers have not been fully efficient in carrying out their farming system.

In general, management and institutional roles affect the profit inefficiencies in organic rice farming system. Institutional factors that cause profit inefficiencies in organic rice farming system are the frequency of participation in extension and is significant at $\alpha = 5\%$, the frequency of participation in training ($\alpha = 1\%$), and the role of institutions or associations ($\alpha = 1\%$). While the management factors that become the cause of profit inefficiencies in organic rice farming system are the farmers'age which is significant at $\alpha = 10\%$ and management of farming system, significant at $\alpha = 1\%$. Institutional and other management factors, namely the

Table 2
Estimation of factors causing profit inefficiencies in organic rice farming system

Variable	Parameter	Coefficient of regression	Standar error	t-count
Constant	d0	-0.0100NS	0.9059	-1.105
Farmers' age	d1	-0.0002*	0.0121	-1.729
Formal education level of the farmers	d2	-0.0449NS	0.0337	-1.331
Period of organic farming	d3	-0.0465NS	0.0526	-0.883
The number of family members of the farmers	d4	-0.0966NS	0.0865	-1.118
Frequency of participation in counseling	d5	-0.0006**	0.0307	-2.006
Frequency of participation in training	d6	-0.0992***	0.037	-2.681
Courses about organic farming	d7	-0.0369NS	0.0473	-0.779
The role of farmers group and agricultural counselors	d8	-0.0637NS	0.0592	-1.077
The role of institution	d9	-0.0989***	0.0254	-3.889
Farming system management	d10	-0.2735***	0.0966	-2.831
sigma-square		0.7776***	0.1619	4.802
Gamma		0.9999***	0.0003	38.38
log likelihood function		410.347		
LR test of the one-sided error		783.2011		
mean efficiency		0.3782		

Source: primary data 2016
*** = 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%

level of formal education of the farmers, period of organic rice farming, the number of the farmers' family member, coaching or courses of organic rice farming, and the role of farmer groups and agricultural counselors do not statistically show actual effect (non significant) on the profit inefficiencies in organic rice farming (α = 10%). The results of estimation causes of profit inefficiencies in organic rice farming system are shown in Table 2.

All institutional and management factors negatively affect the profit inefficiencies in organic rice farming system. This shows that by increasing the value of institutional and management variables that cause inefficiencies will make organic rice farming become more efficient (inefficiency downhill).

Management of farm system is the most dominant variable in determining the profit inefficiencies in organic rice farming system with coefficient value of -0.2735, which means the higher the value of the variable, the profit inefficiencies in organic rice farming system will ever decrease. The second biggest variable is the variable of frequency of participation in training with coefficient of -0.0992, which means the more frequent the farmers participate in training assembled with organic rice farming, the profit inefficiencies in organic rice farming system will increasingly fall. The third biggest factor in reducing profit inefficiencies of organic rice farming is the role of institutions or associations with a coefficient of -0.0989, which means the greater than the value of the variable, the profit inefficiencies in organic rice farming system will ever decrease. Furthermore, variable of frequency of participation in counseling has coefficient value of -0.0006, which means the more often the farmers participate in counseling associated with organic rice farming, the profit inefficiencies in organic rice farming will be reduced. Variable of farmers age has a coefficient of -0.0002, which means the older the age of the farmer will reduce the profit inefficiencies in organic rice farming system.

The results of the study (Table 1) shows that farmers are still not capable of running an organic rice farming system efficiently. So the value of the input factors of production are still higher, or in other words can not be combined well, thus causing inefficiencies. This is indicated by the average value of the efficiency which is quite small, only reaching 0.3782, or only 37.82% (Table 2) that is economically inefficient. To get to the organic rice farming system which is efficient in terms of the use of the input factors of production, we need to improve the institutional role (the role of institutions or associations, the frequency of participation in counseling associated with organic rice farming, and the frequency of participation in training associated with organic rice farming) and management of farming system.

In terms of institutions (the role of institutions or associations, the frequency of participation in counseling, and the frequency of participation in training), to reduce the inefficiencies we need to intensify education and training associated with organic rice farming, such as cultivation technique, marketing, the state of the group, the state of society, and helping each other in management of farming system. Discussion about things assembled with organic rice farming system through farmers' groups and the KUD (*Koperasi Unit Desa*) or Village Unit Cooperatives. While in terms of management of farming system, to reduce the inefficiencies we need to implement good management of farming system, such as: the use of good cultivars seeds, the use of good quality and labeled seeds, proper tillage technique, good maintenance of seedbed, setting the population or the planting regularly and appropriate advice, organic fertilization as needed, effective and efficient irrigation (intermittent irrigation), pest and disease control in an integrated manner and eco-friendly, weed control, good handling of harvesting and post-harvest treatment, and the use of good quality seeds, which are clean, healthy, and labeled.

Conclusion

In this research, 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. This study examines the social factors effect on the stochastic frontier profit function in organic rice farming system in Dlingo Village, Mojosongo, Boyolali, Central Java, Indonesia. From the stochastic frontier Cob-Douglas profit function that estimated with MLE (Maximum Likelihood Estimation), the value of the log likelihood function with MLE method is 410.3470. It is much greater than the value of the log likelihood function with OLS (Ordinary Least Squares) on 249.5071 and it indicates that the MLE method is in accordance with the field conditions in Dlingo Village, Mojosongo, Boyolali, Central Java, Indonesia.

Based on the result of the research can be summarized that there were four variables of the use of inputs value negatively affecting the profit of organic rice farming system namely the value of seeds, the value of solid organic pesticide, the value of family labor, and the value of tractors rental fee. While variable of the value of land lease positively affected the profit of organic rice farming system. From Table 1 can be shown that organic rice farming system of cv. *mentik wangi* as dummy 1 had the largest amount of profits compared to the other cultivars, such as IR64, *pandan wangi*, and *beras merah*. And in Table 2 can be seen that the average value of profit efficiency in organic rice farming system was 0.3782 and statistically, there were three institutional factors, namely frequency of participation in counseling, frequency of participation in training, and the role of institution or association that negatively affecting the profit inefficiency in organic rice farming system. In addition, there were two managerial factors negatively affecting the profit inefficiency in organic rice farming system, namely farmers'age and management of farming system.

Like most studies, this study is subjected to some limitations. First, the sample size is limited to only two farmers' groups in Boyolali. Second, we can not assume about the levels of purity of organic rice and the type of local cultivars were grown continually in Boyolali. Third, the presence of the uncertain weather changes and can not be used as a measure of the time for planting. The problem of the production risk as a side effect from the production and profit of organic rice farming system may be investigated in future research.

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