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# Comparative Study of Management Effect and Agricultural Institutions on Organic Rice Farming in Mojosongo District, Indonesia

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***Abstract:*** *This study aims to analyze the influence of management factor and agricultural institutions variables. These two variables are very influential on efficiency of production, production cost and profit of organic rice farming. This research was conducted in Dlingo Village, Mojosongo District, Boyolali Regency, Central Java Province, Indonesia with a sample of 216 organic rice farmers certified by Internal Control System and nationally selected by the purposive sampling method. This comparative study was conducted using a stochastic frontier approach with cross section data and estimated using Maximum Likelihood Estimation. The results of this study are the farming system management variable being the dominant variable affecting production inefficiency and profit inefficiency with coefficient values of -0.4527 and -0.2735, and being the second largest variable affecting the inefficiency of production cost with a coefficient value of -0.4409. The role variable of farmer groups and agricultural counselors are the dominant variables that influence the inefficiency of production cost with a coefficient value of -0.5497. From the management side, it can be seen that all organic rice farmers (100%) use superior varieties of seeds, carry out perfect tillage as recommended (100%), and maintain nursery well (100%). In terms of agricultural institutions, in this case the role of farmer groups and agricultural counselors can be seen that all respondent farmers (100%) are members of farmer groups. Farming system management variable is the variable that has the most influence on production, production cost and profit efficiency.*

***Keywords****: Mojosongo, Management, Agricultural institutions, Organic rice farming, Stochastic frontier*

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## I. Introduction

Recently environmental problems have arisen related to natural phenomena, such as extreme weather and environmental damage due to floods, landslides, hurricanes, earthquakes, drought, etc. Among those problems, there are problems related to the agricultural environment, namely the damage to the soil due to excessive pollution of fertilizers and chemical pesticides. Soil damage due to chemical pollution can have an impact on plants and supporting components of soil and human fertility (1).

To address the environmental pollution caused by chemical fertilizers and pesticides, it is necessary to strive for a sustainable development model that is concerned with environmental health for present and future generations. The concept of sustainable development is an approach that arises from the concerns of many countries due to excessive exploitation of human resources, which has an impact on environmental health. Sustainable development is a process and condition that includes the adjustment over time between natural resources, socio-cultural inputs, and technology to maintain a dynamic balance towards adequate capacity of natural resources for future generations (2). Sustainable development can be understood as the management or conservation of natural resources and the orientation of technological and institutional changes in such a way that it can guarantee the continuous fulfillment of human needs for present and future generations. One factor that must be faced to achieve sustainable development is how to repair the destruction of the environment without compromising the need for economic development and social justice in it (3).

In sustainable development there is an environmentally friendly sustainable agriculture system that needs to be endeavored to increase natural resources and human resources, in three aspects, namely environmental, social and economic aspects. Food and Agriculture Organization (FAO) has developed a model and explained the concept of sustainable agriculture and rural development as the management and conservation of natural resources oriented to technological and institutional changes in an effort to meet human needs, both current and future generations (4). Sustainable agriculture is an agricultural movement that uses the principles of ecology, the study of the relationship between organisms and their environment. This can be interpreted that sustainable agriculture has become an integrated system between crop and animal production practices in a supportive environment in the future (5).

Organic farming as one part of sustainable agriculture is present by providing insight into environmentally friendly agriculture and producing healthy food products (6). Organic farming can be said to be an agricultural process that utilizes nature and the surrounding environmental conditions. The methods and technologies of organic farming systems are local knowledge and wisdom that have grown and developed from generation to generation. International Federation of Organic Agricultural Movement (IFOAM) explains organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved (7).

To realize organic agriculture that is environmentally friendly and produces healthy food products in a sustainable manner, it is necessary to have good agricultural management and institutions. Agricultural management and institutions that are well implemented to farmers will be able to reduce inefficiencies in production, production costs and the benefits of organic rice farming systems. This study intends to analyze the comparative influence of agricultural management and institutional variables in relation to production, production cost and profit efficiency of organic rice farming with a stochastic frontier approach.

## II. Literature Review

In the wetland rice farming system, both organic and inorganic, it is necessary to have efficiency to increase productivity and reduce losses, between technical, allocative and economic in nature. The study of economic efficiency begins with the Cobb-Douglas production function which is then developed with a stochastic frontier approach. The reasons for using the Cobb-Douglas production function are: (1) it is homogeneous, so it can be used to reduce the cost function and production function, (2) it is simpler and not complicated to use, (3) rarely causes problems, and (4) is widely used in many developed and developing countries. Nevertheless, the function has a weakness, namely the presence of constant input elasticity and return to scale (8).

Today more technical efficiency or production efficiency studies are related to conventional rice. However, there are some researchers who examined the technical efficiency or production efficiency of organic rice with a stochastic frontier approach, such as in research (9-14). In addition to technical efficiency, there are also studies allocative efficiency or production cost efficiency of organic and conventional rice using a stochastic frontir approach, such as that conducted by (15-20). In addition to technical efficiency or allocative efficiency, there are also studies economic efficiency or profits efficiency of organic and conventional rice using a stochastic frontier approach, as conducted by (21-27). In addition to technical, allocative, or profit efficiency, there are also several agricultural studies that discuss the behavior of farmers in facing the production risk, both organic and conventional rice, as conducted by (28-31).

From studies of technical, allocative, and economic efficiency rice, both organic and conventional, there are various variables used by researchers to determine the value of efficiency, for example: the age of farmers, the level of formal education of farmers, the duration or experience of farmers farming, the number of household members of farmers, farmers' participation in agricultural institutions, farming system management, and so on. Research relating to the management and institutions of organic rice farming as a variable that determines the value of efficiency, both technical, allocative, and economic efficiency has been widely studied by (32,9,10,26,20,14).

## III. Theoretical Framework

Farrell (1957); Coelli et al. (1998) states that efficiency is classified into three, namely technical efficiency (TE), allocative efficiency (AE), and economic efficiency (EE) (33,34). Technical efficiency (TE) 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. Cost efficiency/ allocative efficiency (AE) is the ability of farmers to use inputs at optimal proportions at factor prices and fixed production technology (given). Cost efficiency shows the relative ability of a farm to use inputs to produce output under conditions of minimal cost or maximum profit at a certain technological level. Yotopoulos and Nugent (1976) stated that the combination of technical efficiency (TE) and allocative efficiency (AE) would be economic efficiency (EE) (35). Economic efficiency is understood as the ability of farmers to produce a predetermined number of outputs. This means that the products produced, both technically and allocatively, are efficient. Economically seen as efficient because the combination of input-output will be in frontier production function and business development path.

**Stochastic Frontier Production Function**

Stochastic frontier production function is an extension of the original deterministic models to measure the unpredictable effects in the production limits (36-39). In his production function, the random error ($V_i$) is added to the non-negative random variable ($U_i$), as stated in the following equation 1 below:

$$Y = \alpha_0 + \alpha_i X_i + \ldots + \alpha_k X_k + (V_i - U_i), \; i = 1,\ldots,N \qquad (1)$$

where:

$Y$ = organic rice production in natural logarithm (ln)
$X_i$ = number of inputs used in production process in natural logarithm (ln)
$\alpha_0$ = constant
$\alpha_{i\text{-}k}$ = estimated parameter
$V_i$ = error factors caused by factors beyond the farmers' control
$U_i$ = error factors caused by factors under the farmers' control

Random error ($V_i$) is useful to calculate the size of errors and other random factors such as weather, and others together with the effects of the combination of input variables that are undefined in the production function. Random error ($V_i$) variables are independent random variables and normally distributed (independent identically-distributed) with zero mean and constant varians. $U_i$ variable is assumed as i exponential or half-normal random variables $U_i$ variable serves to capture the effects of technical inefficiency.

**Stochastic Frontier Cost Production Function**

Aigner et al. (1977); Meeusen and Van den Broeck (1977); Jondrow et al. (1982); Coelli (1996) suggested that stochastic frontier function is an extension of the original deterministic models to measure the unpredictable effects in the production limits. In his production function, random error ($V_i$) is added into non-negative random variable ($U_i$) (36-39). Random error ($V_i$), is useful to calculate the size of the error and other random factors such as weather and others together with the effect of the combination of input variables that are undefined in the production function. Variable $V_i$ is a random variable that is independent and identically distributed normal (independent identically-distributed) with zero mean and constant variant. Variable $U_i$ is assumed as i exponential or half-normal random variable (half-normal variables). If we want to determine the stochastic frontier cost function, we just change the specification of error of ($V_i$ - $U_i$) to ($V_i$ + $U_i$) so that this substitution will alter the production cost function in the equation 2 below:

$$C_i = X_i \beta + (V_i + U_i) \qquad ,i=1,\ldots,N, \qquad (2)$$

where:

$C_i$ = production cost of organic rice in natural logarithm (ln)
$X_i$ = input price normalized with output price in natural logarithm (ln)
$\beta$ = parameter
$V_i$ = errors caused by factors beyond the farmers'control
$U_i$ = errors caused by factors under the farmers'control

In the cost function, $U_i$ now determine how far farmers operate their farming system above the limit cost. If allocative efficiency is assumed, $U_i$ is closely related to the cost of technical inefficiency. If this assumption is not made, the interpretation of $U_i$ in the cost function is less clear, with both technical and allocative inefficiency used.

**Stochastic Frontier Profit Function**

Aigner et al. (1977); Meeusen and van den Broeck (1977); Jondrow et al. (1982); 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 (36-39). 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 in equation 3:

$$\pi^* = \frac{\pi}{p} = G^*\left(W_1^*, W_2^*, \ldots, W_m^*; Z_1, Z_2, \ldots, Z_n\right) \text{- Exp } (V_i\text{-}U_i) \qquad ,i=1,\ldots,N, \qquad (3)$$

where:

$\pi^*$ = profit of organic rice normalized in natural logarithm (ln)
$p$ = output price

$\beta$ = coefficient of the use of unfixed input
$W_i$ = value of unfixed input normalized with output price
$Z_i$ = 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

## IV. Data and Methodology

**Research Place and Sample Farmers**

This research was conducted in Dlingo Village, Mojosongo District, Boyolali Regency, Central Java Province, Indonesia. Boyolali Regency, specifically Mojosongo District was chosen as an area of research on organic rice farming because there are still many farmers who actually do ICS (Internal Control System) and national organic rice farming. In addition, the areas studied are located in a stretch of rice fields that have been organic for a long time and are separated from conventional rice fields, have the same source of irrigation, namely underground springs that have never been depleted of irrigation, and farmers in the area can do three planting season in one year. In this study the total population of ICS certified organic farmers nationally was 521 farmers. From a population of 521 farmers then a sample of 216 organic rice farmers was taken. Sampling uses a purposive sampling method.

**Data Analysis of Stochastic Frontier Production Function**

In this research, data was analyzed with stochastic frontier production function (with cross section data) and then was estimated with Maximum Likelihood Estimation (MLE). Stochastic frontier production function is an original deterministic model to measure the unpredictable effects in the production limits. Stochastic frontier production function is formulated in equation 4 below:

$$Y = \alpha_0 + \alpha_i X_i + \ldots + \alpha_k X_k + (V_i - U_i),\ i = 1,\ldots,N \qquad (4)$$

where:
$Y$ = organic rice production in natural logarithm (ln)
$X_i$ = number of inputs used in production process in natural logarithm (ln)
$\alpha_0$ = constant
$\alpha_{i\text{-}k}$ = estimated parameter
$V_i$ = error factors caused by factors beyond the farmers' control
$U_i$ = error factors caused by factors under the farmers' control

To see the effect of the variables determining the level of production inefficiency on organic rice farming system in Mojosongo District, Boyolali Regency can be formulated as follows in equation 5:

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_9 Z_9 + \delta_{10} Z_{10} \qquad (5)$$

where:
$U_i$ = production inefficiency
$Z_1$ = farmer's age (years old)
$Z_2$ = formal education level of the farmer (years)
$Z_3$ = period of organic rice farming system (years)
$Z_4$ = number of family members (person)
$Z_5$ = frequency of participation in extension (times)
$Z_6$ = frequency of participation in training (times)
$Z_7$ = coaching or courses about organic rice farming (score)
$Z_8$ = the role of farmer groups and agricultural counselors (score)
$Z_9$ = the role of institutions (score)
$Z_{10}$ = farming system management (score)
$\delta_0$= constant
$\delta_{1,..,10}$ = coefficient of regression on determinant factors of technical inefficiency

**Hypothesis**

Testing a hypothesis on the variables that influence the production inefficiency can be formulated as follows:
$H_0$: $\delta_i = 0$ : 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 faming in Mojosongo District, Boyolali Regency.
$H_1$ :$\delta_i \neq 0$ : 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 Regency.

**Data Analysis of Stochastic Frontier Production Cost Function**

To determine the effect of management and institutional variables on the production cost efficiency of organic rice farming system in Mojosongo District, Boyolali Regency, stochastic frontier production cost function with cross section data and the estimation was used. Stochastic frontier production cost function is assumed to have Cobb-Douglas function form that transformed into natural logarithm (ln). Stochastic frontier production cost function is formulated in equation 6:

$$C = \beta_0 + \beta_i P_i + ,\ldots, + \beta_k P_k + (V_i + U_i) \quad (6)$$

where:

$C_i$ = production cost of organic rice in natural logarithm (ln)
$P_i$ = input price normalized with output price in natural logarithm (ln)
$\beta_0$ = constant
$\beta_{i\text{-}k}$ = estimated parameter
$V_i$ = errors caused by factors beyond the farmers'control
$U_i$ = errors caused by factors under the farmers'control

To see the effect of the variables determining the level of production cost inefficiency on organic rice farming system in Mojosongo District, Boyolali Regency, the following formula is used in equation 7:

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_9 Z_9 + \delta_{10} Z_{10} \quad (7)$$

where:

$U_i$ = production cost inefficiency
$Z_1$ = the farmer's age (years old)
$Z_2$ = formal education level of the farmer (years)
$Z_3$ = period of organic rice farming system (years)
$Z_4$ = number of family members (person)
$Z_5$ = frequency of participation in extension (times)
$Z_6$ = frequency of participation in training (times)
$Z_7$ = coaching or courses about organic rice farming (score)
$Z_8$ = the role of farmer groups and agricultural counselors (score)
$Z_9$ = the role of institutions/ associations (score)
$Z_{10}$ = farming system management (score)
$\delta_0$ = constant
$\delta_{1,..,10}$ = coefficient of regression on determinant factors of production cost inefficiency

**Hypothesis**

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

$H_0$:$\delta_i = 0$: 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 Regency.

$H_1$:$\delta_i \neq 0$: 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 Regency.

**Data Analysis of Stochastic Frontier Profit Function**

To determine the influence of the role of management and institutional variables on the profit inefficiency of organic rice farming in Mojosongo District, Boyolali Regency, stochastic frontier profit function was applied and it was estimated by using MLE (Maximum Likelihood Estimation). To see the effect of the determinants of the level of the profit inefficiency of organic rice farming system in Mojosongo District, Boyolali Regency, the formula used was as follows in equation 8 below:

$$\pi^* = \frac{\pi}{p} = G^*\left(W_1^*, W_2^*, ..., W_m^*; Z_1, Z_2, ..., Z_n\right) \text{- Exp } (V_i\text{-}U_i) \quad ,i=1,\ldots,N, \quad (8)$$

where:

$\pi^*$ = profit of organic rice normalized in natural logarithm (ln)
p = output price
$\beta$ = coefficient of the use of unfixed input
$W_i$ = value of unfixed input normalized with output price
$Z_i$ = 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

To see the effect of the variables determining the level of profit inefficiency in organic rice farming system in Mojosongo District, Boyolali Regency, the following formula is used in equation 9:

$$U_i = TE_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_9 Z_9 + \delta_{10} Z_{10} \quad (9)$$

where:

$U_i$ = profit 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)
$\delta_0$ = constant
$\delta_{1,..,10}$ = coefficient of regression on determinant factors of profit inefficiency

**Hypothesis**
Testing a hypothesis on the variables that influence the profit inefficiency can be formulated as follows:
$H_0$ : $\delta_i = 0$ : 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 Regency.
$H_1$ : $\delta_i \neq 0$ : 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 Regency.

## V. Results

**Variables that Affect Production Inefficiency**

The variables of farmers age, organic rice farming period, the number of family members, and training/ courses about organic rice farming statistically explained no significant effects on technical inefficiency of organic rice farming at α = 10%. Determinant factors of technical inefficiency of organic rice farming system (formal education level of farmers, the frequency of participation in extension, the frequency of participation in training, the role of farmer groups and agricultural counselors, the role of institutional, and farming system management) had a negative coefficient. It suggests that the higher the value of these variables, then the inefficiency will decrease. From the most influence variables toward technical inefficiency of organic farming, variable of farming system management was the most dominant variable in determining the technical inefficiency of organic rice farming with coefficient value of -0.4527, which means the higher the value of farm management, the technical inefficiency of organic rice farming will further go down. It can be seen on Table 1 below:

**Table 1:** Estimation result of variables affect production inefficiency

| Variable | Parameter | Coefficient of Regression | Standard Error | t-count |
|---|---|---|---|---|
| Constant | $Z_0$ | -5.0529 | 0.0289 | -1.760 |
| Farmers age | $Z_1$ | $0.0099^{NS}$ | 0.0105 | 0.939 |
| Formal education level of farmers | $Z_2$ | $-0.0451^{*}$ | 0.0281 | -1.697 |
| Organic rice farming period | $Z_3$ | $-0.0726^{NS}$ | 0.0477 | -1.623 |
| Number of farmers' family members | $Z_4$ | $-0.0935^{NS}$ | 0.0760 | -1.231 |
| Frequency of participation in extension | $Z_5$ | $-0.0231^{***}$ | 0.0044 | -5.275 |
| Frequency of participation in training | $Z_6$ | $-0.1734^{***}$ | 0.0592 | -2.930 |
| Counseling/ course about organic farming | $Z_7$ | $-0.0359^{NS}$ | 0.0425 | -0.845 |
| The role of farmer groups and agricultural counselors | $Z_8$ | $-0.0995^{**}$ | 0.0536 | -1.856 |
| The role of institutional | $Z_9$ | $-0.1651^{***}$ | 0.0531 | -3.107 |
| Farming system management | $Z_{10}$ | $-0.4527^{***}$ | 0.1461 | -3.098 |

Source: Analysis of Primary Data 2016
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%

**Variables that Affect Production Cost Inefficiency**

There are several factors predicted to be the cause of the inefficiency of the production cost of organic rice farming, including: farmers' age; formal education level of farmers; period of organic rice farming; the number of farmers' family members; the frequency of participation in extension; frequency of participation in training, coaching, or courses about organic rice farming; the role of farmer groups and agricultural counselors; the role of institutions or associations; and farming system management on organic rice farming. From the most influence variables toward cost production inefficiency of organic farming, variable the role of farmer groups and agricultural counselors was the most dominant variable in determining the cost production inefficiency of organic rice farming with coefficient value of -0.5497, which means the higher the value of the role of farmer groups and agricultural counselors, production cost inefficiency of organic rice farming will further go down. It can be seen on Table 2 below:

**Table 2:** Estimation result of variables affect production cost inefficiency

| Variable | Parameter | Coefficient of Regression | Standard Error | t-count |
|---|---|---|---|---|
| Constant | $Z_0$ | -0.1249*** | 0.0274 | -4.383 |
| Farmers age | $Z_1$ | 0.0009*** | 0.0023 | 4.125 |
| Formal education level of farmers | $Z_2$ | -0.0421*** | 0.0067 | -6.268 |
| Organic rice farming period | $Z_3$ | 0.1092NS | 0.1584 | 0.689 |
| Number of farmers' family members | $Z_4$ | -0.1376NS | 0.2295 | -0.599 |
| Frequency of participation in extension | $Z_5$ | -0.1255*** | 0.0193 | -6.391 |
| Frequency of participation in training | $Z_6$ | 0.0273NS | 0.0628 | 0.434 |
| Counseling/ course about organic farming | $Z_7$ | -0.2927*** | 0.0496 | -5.898 |
| The role of farmer groups and agricultural counselors | $Z_8$ | -0.5497*** | 0.0921 | -5.597 |
| The role of institutional | $Z_9$ | -0.0495** | 0.0214 | -2.317 |
| Farming system management | $Z_{10}$ | -0.4409*** | 0.1458 | -3.024 |

Source: Analysis of Primary Data 2016

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% | | |

**Variables that Affect Profit Inefficiency**

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 farming system management. From the most influence variables toward the profit inefficiency of organic farming, variable of farming system management was the most dominant variable in determining the profit inefficiency of organic rice farming with coefficient value of -0.2735, which means the higher the value of farming system management, the profit inefficiency of organic rice farming will further go down. It can be seen on Table 3 below:

**Table 3:** Estimation result of variables affect profit inefficiency

| Variable | Parameter | Coefficient of Regression | Standard Error | t-count |
|---|---|---|---|---|
| Constant | $Z_0$ | -0.0100NS | 0.9059 | -1.105 |
| Farmers age | $Z_1$ | -0.0002* | 0.0121 | -1.729 |
| Formal education level of farmers | $Z_2$ | -0.0449NS | 0.0337 | -1.331 |
| Organic rice farming period | $Z_3$ | -0.0465NS | 0.0526 | -0.883 |
| Number of farmers' family members | $Z_4$ | -0.0966NS | 0.0865 | -1.118 |
| Frequency of participation in extension | $Z_5$ | -0.0006** | 0.0307 | -2.006 |
| Frequency of participation in training | $Z_6$ | -0.0992*** | 0.037 | -2.681 |
| Counseling/ course about organic farming | $Z_7$ | -0.0369NS | 0.0473 | -0.779 |
| The role of farmer groups and agricultural counselors | $Z_8$ | -0.0637NS | 0.0592 | -1.077 |
| The role of institutional | $Z_9$ | -0.0989*** | 0.0254 | -3.889 |
| Farming system management | $Z_{10}$ | -0.2735*** | 0.0966 | -2.831 |

Source: Analysis of Primary Data 2016

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% | | |

## VI. Discussion

**The Role of Farming System Management as a Dominant Variable**

Until now, problems in the farming system are still often found, including organic rice farming. One important aspect to reduce these problems is by managing the farm properly using the principles of farm management. Farm management is the ability of farmers to determine, organize, and coordinate the factors of production that are best controlled in order to be able to provide agricultural productivity as expected. In this study the farming system management variable becomes the dominant variable that affects production inefficiency and profit inefficiency with coefficients of -0.4527 and -0.2735, respectively, and becomes the second largest variable after the role of farmer groups and agricultural counselors that affect the inefficiency of production cost with coefficient values amounting to -0.4409. This indicates that the role of farming management system in organic rice farming is very important.

The elements of organic rice farming management referred to here are: whether the seeds used by farmers are superior varieties of seeds, quality and labeled seeds, farmers carry out perfect soil management as recommended, farmers carry out nursery maintenance well, population regulation or planting arrangements are carried out regularly and precisely as recommended, farmers provide organic fertilizer according to soil needs, water supply (irrigating) rice plants are carried out effectively and efficiently in accordance with soil conditions (intermittent irrigation), pest and disease control is carried out in an integrated and environmentally friendly manner, weed control done properly and handling the harvest process and post-harvest is done well. This can be seen in Table 4 below:

**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 |

Source: Analysis of Primary Data 2016

From the response of organic rice farmers 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).

**The Role of Agricultural Institutions as a Dominant Variable**

In addition to farming system management, the role of farmer groups and agricultural counselors as agricultural institutions is also important. The role variable of farmer groups and agricultural counselors are the dominant variables that influence the inefficiency of production cost with a coefficient of -0.5497. This means that the higher the value of the role of farmer groups and agricultural counselors, the inefficient production cost of organic rice farming will decrease.

Discussions on the role of farmer groups and agricultural counselors can be seen in Table 5. It shows that all respondent farmers (100%) are members of farmer groups and 99.10% of farmer group members hold regular meetings in their groups with attendance of 70.40% . There are still 29.60% of farmers who are absent and if the presence of farmers can be increased, then counseling conducted by farmer groups and agricultural counselors can be more effective and beneficial for farmers.

**Table 5:** Description of the role of farmer groups and agricultural counselors

| No. | Description of the role of farmer groups and agricultural counselors | Farmer response | |
|---|---|---|---|
| | | Yes | No |
| 1. | Farmers become members of farmer groups | 100.00 | 0.00 |
| 2. | Regular meetings in groups | 99.10 | 0.90 |
| 3. | Farmers are always present at the meeting | 70.40 | 29.60 |
| 4. | Material discussed in group meetings: | | |
| | Agricultural cultivation techniques | 88.00 | 12.00 |
| | Marketing of agricultural products | 74.10 | 25.90 |
| | Farmer groups conditions | 86.10 | 13.90 |
| | Circumstances of the surrounding community | 49.10 | 50.90 |
| 5. | Facilitators who often provide counseling to farmers: | | |
| | Agricultural counselors | 95.40 | |
| | Village officials | 0.10 | |
| | The chairman of farmer groups | 4.50 | |
| 6. | Extension institutions that are widely known by farmers: | | |

| | | | |
|---|---|---|---|
| | Agricultural Extension Center<br>Agricultural Extension Information Center<br>Farmer groups | 8.10<br>1.80<br>90.10 | |
| 7. | Farmer groups in one area help one another in managing farms on the farms of group members (plowing rice fields, water management, planting, etc.) | 94.40 | 5.60 |

Source: Analysis of Primary Data 2016

In farmer groups, the material discussed in group meetings is about technical cultivation, marketing, group conditions, and community conditions. The material most responded by farmer group members was material on cultivation techniques (land management, irrigation, nursery, stacking and post-harvest handling) at 88%, followed by problems with group conditions (problems that existed in farmer groups such as: contributions, distribution water, making organic fertilizer, making organic pesticides) with a value of 86.10%. Marketing material, which is about objectives, number of requests, prices, marketing costs and transportation problems, was responded to by 74.19%. The smallest material to be responded by farmers is about the state of the community by 49.10%. Farmers largely assume that the problem of the state of society is the responsibility of village government officials.

## VII. Conclusion

Farming system management systems and agricultural institutions are two important things that support the success of organic rice farming in Dlingo Village, Mojosongo District, Boyolali Regency, Central Java Province, Indonesia. The farming system management variable becomes the dominant variable affecting production inefficiency and profit inefficiency with coefficients of -0.4527 and -0.2735, respectively, and being the second largest variable affecting the inefficiency of production cost with a coefficient of -0.4409. The role variable of farmer groups and agricultural counselors are the dominant variables that influence the inefficiency of production cost with a coefficient of -0.5497.

From the management side, it can be seen that all 100% organic rice farmers use superior varieties of seeds, besides that the farmers also carry out perfect tillage according to the recommendation (100%) and maintain nursery well (100%). In terms of agricultural institutions, in this case the role of farmer groups and agricultural counselors can be seen that all respondent farmers are 100% members of farmer groups and 99.10% of members of farmer groups hold regular meetings in their groups with attendance of 70.40%. Between the farming system management variable and the agricultural institutional variable (the role of the farmer groups and agricultural counselors) it can be concluded that the farming system management variable is the variable that has the most influence on production, production cost and profit efficiency.

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