Agricultural Socio-Economics Journal
Volume 18, Number 2 (2018): 79-85

P-ISSN: 1412-1425
E-ISSN: 2252-6757

FACTORS THAT INFLUENCE TECHNICAL EFFICIENCY OF ORGANIC PADDY FARMING IN SUMBERNGEPOH VILLAGE, LAWANG SUB DISTRICT, MALANG DISTRICT

Agil Narendar[1*], Nuhfil Hanani[2] , Syafrial[2]

[1] Post Graduate Student at Economics Agriculture, Brawijaya University, Indonesia
[2] Lecturer at Socio-Economics Agriculture/Agribusiness Department, Brawijaya University, Indonesia

*corresponding author: agil.narendar@gmail.comm

Abstract: The production and productivity of organic paddy tends to lower than non organic paddy. The constraints for production and productivity of organic paddy are the gap of transition period of conventional to organic farming and the huge influence of input usage. The technical efficiency concept is the suitable choice to determine the minimum input that farmer obtained to certain outputs. There are some factors that can influence farmers in decision making for using input. The purposes of this research were to analyze factors that influence the efficiency of organic paddy farming technique in Sumberngepoh Village. The research was conducted at Gapoktan (farmers group) "Sumber Mulyo" in Sumberngepoh Village, Lawang Sub District, Malang District with 45 samples of farmer. The data used in this research was data of farming during rainy season of 2016-2017. The data was analyzed by using Tobit regression. The result showed that the factors which influence and gave significantly positive towards farming efficiency technique were participation of field school, field control by farmers group, planting method and planting seasons.

Keywords: organic paddy, technical efficiency, tobit regression

INTRODUCTION

The changing of life style from unhealthy to healthier food consumption has made organic farming wide developed. Based on Estuningtyas *et al* (2013), organic farming is one of the solution for providing good quality of food. Moreover the expensiveness price of organic food compare to chemical food has been another attracting point despite delivering lower yields (Shioutsu et al, 2015).

Indonesia has great opportunity to develope organic farming as it is ranked in big five of Asia's country based on area cultivated for organic farming, with an increasing trend every year during periode of 2013-2015 (Research Institute of Organic Agriculture, 2017). One of the commodity of organic farming is paddy. Sullivan (2003) stated that organic paddy has special characteristics based on *on-farm* and *off-farm*. *On-farm* is cultivation technique that related to the using of natural fertilizer and crop rotation to maintain soil fertility. While *off-farm* is related to the selling of organic paddy which is organic rice.

Asrulhoesein (2010) has projected that the market needs of organic products will be rising from year 2005 to 2009. Although organic paddy production keep increasing but the market needs only has reached 550,3 kwintal at year 2005, whereas in year 2006-2009 is in insufficiency. The insufficiency supply of organic paddy to market is caused by low production and productivity of organic paddy. The organic paddy grain often lower than non organic paddy/conventional (Surekha et al, 2013). It is happened because organic paddy farming usually needs more time in transition period which are includes the recovery of physics, chemical and biology of soil gradually until it becomes stable. Furthermore, the necessary amount of organic carbon for optimal productivity is more than 2,5% (Neera *et al*., 1999; Padel, 2001; Farmia, 2008). Suwantoro (2008) stated that farmer usually experience low productivity during three planting season in the beginning of organic farming.

The efficient use of input is demand for farmer to gain optimal production result. This concept is known as production efficiency. In development of sustainable agriculture, the measurement of

production efficiency is important as part of decision making, resources management and allocation, and restructuritation of agriculture (Nargis & Lee, 2013). Furthermore, the implication of this decision will reduce poverty and increase food security in district level.

One component in production efficiency is technical efficiency. Technical efficiency is tool for deciding the use of input. Technical efficiency is influenced by some factors such as natural disasters, irigation, planting technique, access to information, planting areal, planting seasons, labour, age, education and farming experience (Kea, Li, dan Pich, 2016; Firmana, 2015).

Tobit regression is a tool to measure factors that influence efficiency. Thipbharos (2013); Wassie (2012); (Geta *et al*., 2013) stated that Tobit regression is a model which was developed by Tobin in 1958 that used for deciding the efficiency factors by using two techniques of estimation and translog production function. Ray (1991) and Worthington & Dollery (1999) measured technical efficiency factors by using DEA to predict the value of technical efficiency, and Tobit regression with econometrica equation.

Sumberngepoh village is one of village in Malang District which produce organic paddy as its main product/commodity. Production of organic paddy in this village is 5 ton per hectar and is constant in last 5 years. This research is conducted to observe factors that influence farmers technical efficiency in Sumberngepoh village.

RESEARCH METHODS

Research sample

This research was conducted on Gapoktan (farmers group) "Sumber Mulyo" in Sumberngepoh Village, Lawang Sub District, Malang District, East Java Province, from November 2016 to February 2017. Total sample were 45 farmers with proportion 15 farmers from "Sumber Makmur I" group and 30 farmers from "Sumber Makmur II" group.

Tobit Regression Model

Tobit regression model was developed by Tobin (1958) with assumption that independent variable was censured, means that independent variable had restricted value, while value of dependent variable was unrestricted. Tobit regression model cannot estimate parameter that use OLS because of its bias, thus Maximum Likelihood is choosen as the best approach (Chu *et al*., 2010).

Dependent variable in this research was technical efficiency value from Data Envelopment Analysis (DEA) method. It was because the value from DEA was restricted from 0-1 (Fethi *et al*., 2000; Hwang and Oh, 2008; Lockheed *et al*., 1981). While the independent variable was factors that influence technical efficiency for organic paddy, which were: organic paddy farming experience (X1), education level of organic paddy farmer (X2), field school (X3), seed variety (X4), access to technology and information (X5), control from farmers group (X6), *dummy* planting method (X7), *dummy* land tenure status (X8), *dummy* planting season (X9).

Mathematically, model specification can be seen below:

$$TE = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X8 + \beta 9X9 + \varepsilon \quad (1)$$

Simultaneous Test (Likelihood Ratio)

Simultaneous test is used to observe the influence of independent variable simultantly with dependent variable. The testing is conducted by using Likelihood Ratio.

Tested hyphothesis can be seen below:

H0 : $\beta 1=\beta 2=\beta 3=\beta 4=\beta 5=\beta 6=\beta 7=\beta 8=\beta 9=0$

There was no correlation silmutantly between farming experience, education level, field school, seed variety, control from farmer group, planting method, land tenure status, and planting seasons with farmer's technical efficiency.

Ha : at least one $\beta i \neq 0$ for i=(1, 2, 3, 4, 5, 6, 7, 8, 9)
or If $X^2 > X^2(n-k)$ or p value < a

Farming experience, education level, field school, seeds variety, access to information and technology, control from group of farmer, planting method, land owning status and planting seasons have effected silmutantly to farmer's technical efficiency

Partial Test (Wald Test)

Partial test is used to observe the partial influence between independent variable and dependent variable. This test is conducted by using Wald test.

The tested hypothesis can be seen below:

Hypothesis 1

- If ρ-value ($\beta 1$) > α (5%, 10%) then Ho is accepted and Ha is rejected, means that organic paddy farming experience does not influence statistically to farmer technical efficiency level.
- If ρ-value ($\beta 1$) < α (5%, 10%) then Ho is accepted and Ha is rejected, means that farming

experience influence positively to farmer techical efficiency level.

Hypothesis 2
- If ρ-value (β2) > α (5%, 10%) then Ho is accepted and Ha is rejected, means that education level of organic paddy farmer does not influence statistically towards farmer technical efficiency level.
- If ρ-value (β2) < α (5%, 10%) then Ho is rejected and Ha is accepted, means that level education of organic paddy farmer influence positively towards farmer technical efficiency level.

Hypothesis 3
- If ρ-value (β3) > α (5%, 10%) then Ho is accepted and Ha is rejected, means that frequency of farmer to participate in field school does not influence significantly towards farmer technical efficiency level.
- If ρ-value (β3) < α (5%, 10%) then Ho is rejected and Ha is accepted, means that frequency of farmer to participate in field school influence positively towards farmer technical efficiency level.

Hypothesis 4
- If ρ-value (β4) > α (5%, 10%) then Ho is accepted and Ha is rejected, means that seed variety (either high or low quality) does not influence statistically towards farmer technical efficiency level.
- If ρ-value (β4) < α (5%, 10%) then Ho is rejected and Ha is accepted, means that seed variety (either high or low quality) influence positively towards farmer technical efficiency level.

Hypothesis 5
- If ρ-value (β5) > α (5% or 10%) then Ho is accepted and Ha is rejected, means that access to technology and information does not influence statistically towards farmer technical efficiency level.
- If ρ-value (β5) < α (5% or 10%) then Ho is rejected and Ha is accepted, means that access to information and technology influence positively towards farmer technical efficiency level.

Hypothesis 6
- If ρ-value (β6) > α (5% or 10%) then Ho is accepted and Ha is rejected, means that control by farmers group does not influence statistically towards farmer technical efficiency level.
- If ρ-value (β6) < α (5% or 10%) then Ho is rejected and Ha is accepted, means that farmers who under control/supervised by farmers group influence positively towards farmer technical efficiency level compared to farmers who do not.

Hypothesis 7
- If ρ-value (β7) > α (5% atau 10%) then Ho is accepted and Ha is rejected, means that planting method (*tegel*, random, *jajar legowo*) does not influence statistically towards farmer technical efficiency level.
- If ρ-value (β7) < α (5% atau 10%) then Ho is rejected and Ha is accepted, means that *tegel* planting method influence positively towards technical efficiency level compared to random and *jajar legowo* planting method.

Hypothesis 8
- If ρ-value (β8) > α (5% atau 10%) then Ho is accepted and Ha is rejected, means that land tenure status (owned and rent) does not affected statistically towards farmer technical efficiency level.
- If ρ-value (β8) < α (5% atau 10%) then Ho is rejected and Ha is accepted, means that owned land tenure status influence positively towards technical efficiency level compared to rent land.

Hypothesis 9
- If ρ-value (β9) > α (5% atau 10%) then Ho is accepted and Ha is rejected, means that planting seasons (rainy and dry season) does not influence statistically towards farmer technical efficiency level.
- If ρ-value (β9) < α (5% atau 10%) then Ho is rejected and Ha is accepted, means that dry season influence positively towards technical efficiency level compared to rainy season.

RESULTS AND DISCUSSION

Research result can be seen on Table 1 below.

Table 1. Analysis Result of Tobit Regression

Variable	Coefficient	Probability (Pr>|t|)	
Intercept	0.727836	0.0000	
Organic Paddy Farming Experience (X1)	-0,002323	0.5548	
Education Level (X2)	0.001816	0.6743	
Field School (X3)	0.016022	0.0772	**
Seeds Variety (dummy) (X4)	0.005006	0.8837	
Technology and Information (dummy) (X5)	-0.002286	0.9275	
Control/Supervision from Farmers Group (dummy) (X6)	0.054690	0.0559	**
Organic Paddy Planting Method (dummy) (X7)	0.108705	0.0017	*
Land Tenure Status (dummy) (X8)	0.016790	0.5722	
Planting Seasons (dummy) (X9)	0.045498	0.0984	**

* Significant at real level 5%

** Significant at real level 10%

Test (Likelihood Ratio)

Simultaneous test was conducted to observe the influence of independent variable towards dependent variable simultaneously. Based on Tobit regression result, the coefficient parameter value of $\beta i \neq 0$, i=(1, 2, 3, 4, 5, 6, 7, 8, 9) and value of X^2 (log likelihood ratio) was 46,87, and was greater than value in Chi Square distribution table with significant level at 0,05 and degree of freedom at 9 ($X^2(9)=16.92$).

Final decision of hypothesis was the rejection of Ho and acceptance of Ha. This result concluded that farming experience, education level, field school, seeds variety, access to technology and information, control from farmers group, planting method, land tenure status, and planting seasons affected silmutaneously towards farmer technical efficiency.

Partial Test (Wald Test)

Partial test showed the influence of independent variable partially towards dependent variable. Based on Tobit regression analysis result, significant variable at real level 5% and 10% were field school (X3), control from farmers group (X6), planting method (X7) and planting seasons (X9). Those results can be detailed as follows:

1. Field School Participation

Farmers participation on field school was 2 times approximately, where the highest participation was 4 times and the lowest was 0 or no participation at all. Result from Tobit regression analysis showed that field school variable affected positively significant at real level 10% towards farmers technical efficiency.

Final decision for hypothesis were the rejection of Ho and the acceptance of Ha, where the higher farmer participation would result the higher farmers technical efficiency. Coefficient value showed a positive value at 0.016 and it meant that every single time the community participation increasing would also increase the technical efficiency value at 0.016. Field school activities held on Sumberngepoh Village were SLPHT of Paddy (2007, 2011), SLTL (2008), Farmer Guide (2012), dan SLPTT Paddy (2013).

2. Planting Method

Organic paddy farmer in Sumberngepoh Village used 3 different planting method which were *jajar legowo*, random and *tegel*. The variable of planting method had significantly positive value at real level 5% towards farmer technique efficiency. It meant that the choosen hypothesis was rejection of Ho and acceptance of Ha, where the use of planting method affected farmer technique efficiency

Coefficient value showed positive at 0,108. It meant that the use of tegel planting method increased farmer technique efficiency as much as 0.108 compared to jajar legowo and random method. The application of planting method has correlation with planting space and can affect the using of production inputs such as seeds, organic fertilizer, pesticide and labours.

3. Control/Supervision from Farmers Group

Tobit regression result showed that control variable had positive value and significant at real level 10%. The choosen hypothesis was the rejection of Ho and acceptance of Ha, where the control from farmers group affected significantly towards farmer technique efficiency level. Coefficient of regression showed positive value at 0.054 and it meant that every single time the control from farmers group increasing would also increase the technical efficiency value at 0.054.

4. Planting Seasons

The last variables in this research was seasons that categorized as Rainy Season and Dry Season. Tobit regression result showed that planting seasons had positive value and significant towards farmer technique efficiency at real level 10%. It meant that the choosen hypothesis was the rejection of Ho and acceptance of Ha, where planting seasons affected farmer technique efficiency.

Coefficient of regression showed positive value at 0.045. This value imply that farmers could increase the technique efficiency level at dry season compared to rainy season. The use of production inputs such as seeds, fertilizer and pesticides will be higher at rainy season. Seeds and fertilizer will be used in larger quantities to anticipate loss due to waterlogging during rainfall. While pesticides will be used more during rainy season because the higher soil moisture may attract pests and diseases attack.

The variables that not statistically significant were farming experience (X1), education level (X2), seeds variety (X4), access to technology and information (X5) and land tenure status (X8). The detailed of this results can be explained as follows:

1. Farming Experience

Farming experience was important for farmers to decide the inputs used in production. Most farmer in Sumberngepoh Village have done organic paddy farming for 9 years approximately, where the shortest was 2 years and the longest was 15 years.

Tobit regression result showed that farming experience did not significantly affected towards technique efficiency at real level 5% and 10%. It meant that the choosen hypothesis was the acceptance of Ho and rejection of Ha, where the periode of farming experience did not affected statistically towards farmer technique efficiency level.

2. Education Level

The lowest education level of farmers was 6 years or equal to elementary school while the highest was 16 years or equal to university degree. The average education level of organic paddy farmer was 8 years or equal to junior high school. Tobit regression result showed that education level variable did not significantly affected to technique efficiency. The choosen hypothesis was the acceptance of Ho and rejection of Ha, where level education did not affect to technique efficiency level.

3. Seeds Variable

Seeds variable was measured by using two categories which were high quality and low quality. Famers who used low quality organic paddy seeds were 88,89% or 40 people. This number was greater than farmers who used high quality organic seeds which were 11,11% or 5 people. Generally the organic paddy seeds variety that used in Sumberngepoh Village were IR64, Ciherang and Pandanwangi.

The Tobit regression result showed that seeds variable variety did not significantly affected technique efficiency at real level 5% or 10%. It meant that the choosen hypothesis was the acceptance of Ho and rejection of Ha, where the use of seeds variable variety (high and low quality) did not affected technique efficiency level. This result was in accordance with reality in the field where farmers only considered seeds variety for increasing production results and not for determining the quantity of seeds use.

4. Access to Technology and Information

Technology and information variables were measured through two categories which were farmers who could not access the technology and information and farmes who could. Farmers who could access technology and information for organic paddy farming was 53,33% or 24 people. While the farmers who could not was 46,67% or 21 people.

Technology and information access received by farmers comes from Field Extension Officer (PPL) and Plant Disease Operation Officer (POPT) of related institution in Lawang Sub District. This access includes demonstration plot making, the application of integrated pest management, the application of farming tools such as tractor, hand sprayer, cooper, vacum frying and information of seeds subsidy.

Tobit regression result showed that access to technology and information did not significantly affected farmer technique efficiency at real level 5% and 10%. It meant that hypothesis Ho was accepted and Ha was rejected, where access to technology and information did not affected statistically towards technique efficiency level. Technology and information accessed by farmers sometimes does not match with paddy field steep slope. In addition, the difficult habit of farmers to adopt new knowledge is also a constraint factor.

5. Land Tenure Status

The variable of land tenure status was dummy that categorized as “Rent” and “Owned”. Farmers who had rent land status were 20% or 9 people while those who owned the land were 80% or 36 people.

Tobit regression result showed that this variable did not significantly affected technique efficiency level. The choosen hypothesis was the acceptance of Ho and rejection of Ha, where land tenure status both rent and owned did not statistically affected farmer technique efficiency level. It meant that inputs use in organic paddy production did not consider the land status whether rent or owned.

CONCLUSION

The factors which significantly influence to farmer technique efficiency were field school participation, control from farmers group, planting method and planting seasons. While the factors which did not significantly influence were farming experience, education level, seeds variety, access to technology and information and land tenure status.

or delivery time so customers are satisfied.

REFERENCES

Asrulhoesein. (2010). Proyeksi Produksi Dan Padi Organik Di Indonesia. Majalah Media Infokom Semai. Bogor: Lembaga Pertanian Sehat (LPS) Dompet Dhuafa.

Chu, Y., Yu, J. & Huangl, Y. (2010). Measuring Airport Production Efficiency Based on Two-

stage Correlative DEA. Paper presented during Industrial Engineering and Engineering Management (IE&EM), 2010 IEEE 17Th International Conference on 29-31 Oct. 2010.

Estuningtyas, D. E., Izzati, M., Purnaweni, H. (2013). Program Analysis And Rice Organic Farming System (ROFS) Implementation In The Semarang District. Waste Technology, 1-5.

Farmia, A. (2008). Development of Organic Rice Farming in a Rural Area, Bantul Regency, Yogyakarta Special Region Province, Indonesia. Journal of Developments in Sustainable Agriculture , 135-148.

Fethi, M. D., P. M. Jackson and T. G. Weyman Jones. (2000). Measuring The Efficiency Of European Airlines: An Application Of DEA And Tobit Analysis. Annual Meeting of the European Public Choice Society, April 26-29, Siena, Italy.

Firmana, Fajar. (2016). Efisiensi Teknis Usahatani Padi di Kabupaten Karawang dengan Pendekatan Data Envelopment Analysis (DEA). Tesis Institut Pertanian Bogor.

Geta, E., Bogale, A., Kassa, B. and Eyasu, E. (2013) Productivity and Efficiency Analysis of Smallholder Maize Producers in Southern Ethiopia. Journal of Hum. Ecol , 41(1): pp 67-75.

Hwang, D. S. and D. Oh. (2008). Do Software Intellectual Property Rights Affect The Performance Of Firms: Case Study Of South Korea. The Third International Conference on Software Engineering Advances, October 26-31, Sliema, Malta.

Kea, Sokvibol., Li, Hua., Pich, Linvolak. (2016). Technical Efficiency and Its Determinants of Rice Production in Cambodia. Journal Economics vol 4 no 22.

Lockheed, M. E., D. Jamison, and L. J. Lau. (1981). Farmer Education And Farm Efficiency: A survey Economic Development Cultural Change 29: 37-76.

Mussa, Essa C., Obare, Gideon A., Bogale, Ayalneh., Simtowe, Franklin P. (2012). Analysis of Resource Use Efficiency in Smallholder Mixed Crop-Livestock Agricultural Systems: Empirical Evidence from the Central Highlands of Ethiopia. Developing Country Studies Vol 2, No 9

Nargis, F., Lee, S. H. (2013). Efficiency Analysis Of Boro Rice Production In North-Central Region Of Bangladesh. The Journal of Animal & Plant Sciences , 527-533.

Neera, P, M Katano, and T Hasegawa. (1999). Comparison of Rice Yield after Various Years of Cultivation. Natural Farming, Plant Production Science.

Padel, S. (2001). Conversion to Organic Farming A Typical Example of the Diffusion of an Innova-tion. Sociologia Ruralis, Vol. 41(1), European Society for Rural Sociology, ISSN 0038-0199.

Ray, S. (1991) Resource Use Efficiency In Public Schools: A Study Of Connecticut Data. Management Science, 37:1620-1628.

Research Institute of Organic Agriculture. (2017). The World Of Organic Agriculture. Swiss: IFOAM.

Shiotsu, F., Sakagami, N., Asagi, N., Suprapta, D. N. (2015). Initiation and Dissemination of Organic Rice Cultivation in Bali, Indonesia. Sustainability, 1-11

Sullivan, Preston. (2003). Organic Rice Production. Appropriate Technologi Transfer for Rural Areas. www.attra.ncat.org

Surekha, K., Rao, K. V., Rani, S. N., Latha, P. C., Kumar, R. M. (2013). Evaluation of Organic and Conventional Rice Production Systems for their Productivity, Profitability, Grain Quality and Soil Health. Agrotechnol, 1-6.

Suwantoro AA. (2008). Analisis pengembangan pertanian organik di Kabupaten Magelang (studi kasus di Kecamatan Sawangan). Semarang: Program Pascasarjana, Universitas Diponegoro.

Thipbharos, Titirut. (2013). Application Of Tobit Regression In Modeling Insurance Expenditure Of Farmer In Thailand. The 7th International Days of Statistics and Economics, Prague, September 19-21, 2013

Tobin, J. (1958). Estimation of Relationships for Limited Dependent Variables. Econometrica, 26, 24-36.

Wassie, S.B. (2012) Application of Stochastic Frontier Model on Agriculture: Empirical Evidence in Wheat Producing Areas of Amhara Region, Ethiopia. BoD – Books on Demand publishing, Germany.

Worthington, A. and Dollery, B. (1999) Allowing For Nondiscretionary Factors In Data Envelopment Analysis: A comparative study of NSW local government. Working Paper Series in Economics, No.99-12, University of New England, Armidale NSW 2351 Australia.