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RESEARCH ARTICLE

ESTIMATION OF EFFICIENCY AND RISK BEHAVIORS PRODUCTIVITY FOR RICE FARMERS IN THE PROVINCE OF JAMBI

[1,*]Saidin Nainggolan, [2]Amri Amir, [3]Napitupulu, D.M.T. and [4]Arman Delis

[1]Pascasarjana Doctoral Studies Program in Economics, Jambi University, Indonesia
[2,4]Faculty of Economics and Business, University of Jambi, Indonesia
[3]Faculty of Agriculture, Jambi University, Indonesia

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ABSTRACT

Rice commodity business is always constrained in situations of risk and uncertainty, which in turn affect technical efficiency. With the information about inputs that increase risk (risk increasing) and a reduced risk (risk decrearising) will help farmers face and avoid risk productivity of paddy. This study aims to estimate technical efficiency and productivity of farmers' risk behavior. Risk productivity were analyzed using Model Khumbakar. Research sites in four districts in Jambi province are considered belong to production center. In general, technical efficiency of rice commodities business in category is moderate, the behavior of rice farmers in face the risk of productivity included in category of avoiding risk (risk averse). Factors that can affect farmers to take more risks, a policy to do is (1) the policy of increasing productivity by introducing modern technologies to farmers (2) mentoring by extension, increase energy agricultural extension so that farmers obtain counseling is better and easier to obtain information on input use optimal (3) add to amount of capital assistance for farmers to undertake the guidance and supervision of aid distributed (4) improving the network of partnerships between farmers, gapoktan, banks and other economies that can support procurement of inputs, credit and marketing.

INTRODUCTION

The development of rice production while this is effective for the last few years., May be relatively difficult to be repeated in the future. This is due to economic crisis and financial difficulties that resulted in reduced subsidies for these activities. With these conditions, some areas of agricultural policy experts interested in observing response to input supply and demand of rice farmers have been reported in several studies (Bapna et al. 1991; David and Barker, 1988; and Guyomard, et al. 1996). But very few have studied response input supply and demand in relation to price changes. Efficiency, risk behavior, production and productivity of rice farmers. Province of Jambi as well as other places, lots of farm production and investment decisions made under uncertainty of commodity prices, crop yields and government policies in agriculture. The government has been keeping subsidized inputs (such as fertilizer) and price support policies to increase farm production. This policy is very contradictory because in order to evaluate this policy, it is first necessary to understand farmer's response to economic stimuli such as a risk factor productivity.

Corresponding author: Saidin Nainggolan,
Pascasarjana Doctoral Studies Program in Economics, Jambi University, Indonesia.

Farmer's response to productivity risk for certain products directed at a lot of conditions, which include resources, especially land and family labor, plant selection and cultivation techniques, employment opportunities outside, product prices and presence of uncertainty income and farmer's attitude towards risk. Further Darmawi (2005) asserts that in any business activity or agribusiness agricultural sector, then business is always faced with a situation of risk and uncertainty. Farmer's response changes in productivity are useful for policy formulation. If farmers respond positively to movement, productivity, supply of rice will be affected by increase in productivity. The effectiveness of policy of increasing productivity depends on magnitude and significance of estimated response of farmers against risk of productivity. Knowledge of impact of other variables on response of production is important for policy makers. The important variables include input prices, changes in technology, farm management, risk and financial constraints must be taken into consideration in studying the response of production in order to study more realistic and useful (Keeney and Hertel 2008). The role of agricultural production response has been getting a lot of attention in empirical studies today. The neoclassical theory of behavioral models of production of farmers in terms of maximum profits has been tested and accepted in literature (Brennan, 1982). Choi and Helmberger (1993). Studies on efficiency in rice production have been carried out. Most of the study describes condition of low technical efficiency achieved by farmers and justify factors that cause their technical inefficiency in a farm by not considering risks and risk behaviors farmers will influence farmer's decision to allocate inputs in farming which in turn will also affect the technical efficiency is achieved. Ignoring existence of risk and risk behavior will lead to a bias towards estimated production function parameters and technical efficiency (Kumbhakar, 2002). From above information it can be subject matter as follows: "How to model productivity function that describes technical efficiency and factors that affect productivity of rice farming? How the behavior of farmers in face of the risk of productivity in rice farming? Of these problems, it can be that the purpose of the is study was Assessing model of production function, the function of productivity, risk function of productivity, technical efficiency, technical inefficiency and the behavior of the productivity of farmers in rice farming.

MATERIALS AND METHODS

This research was conducted in April - August 2016 at four regency in Jambi Province (Kerinci, Sarolangun, Bungo, and Tanjabtim). Data of used are primary data and secondary data. Primary data collected from rice farmers include profile data, use of inputs, outputs and factors that cause inefficiency and production risk. It also collected data about problems faced by farmers in rice farming. Secondary data used to support primary data obtained from Central Bureau of Statistics and Department of Agriculture and other agencies involved in this study. To analyze the efficiency and risk behavior of farmers used the model developed by Kumbhakar (2002). The functional form:

$$Yi = \alpha o\prod_{j-i}^{7} X_1^{\infty} + \beta o\prod_{j-i}^{7} X_1^{n}.e^{vi} - \gamma o\prod_{j-i}^{7} X_1^{n}.e^{vi} \quad \text{........ (1)}$$

Where:

$\alpha o\prod_{j-i}^{7} X_1^{\infty}$ Is a function of the average productivity
$\beta o\prod_{j-i}^{7} X_1^{n}.e^{vi}$ Is a function of the risk of production
$\gamma o\prod_{j-i}^{7} X_1^{n}.e^{vi}$ Is a function of technical efficiency

Y_i : Total productivity of rice (kg / ha)
X_1 : The amount of rice seeds used (kg / ha)
X_2 : The amount of rice seeds used (kg / ha)
X_3 : The amount of fertilizer used on the SP 36 paddy (kg / ha)
X_4 : KCL amount of fertilizer used on rice farming (kg / ha)
X_5 : The amount of organic fertilizer used on rice farming(kg/ha)
X_6 : The amount of labor used in rice farming (HKSP/ha)
X_7 : The amount of chemical insecticides used in rice farming (ltr/ha)
dX8 : The planting season (monsoon = 1, the dry season = 0)
V_1 : Error term to indicate uncertainty about production assumed i.i.d (0,o,,)²
U_i : Error term to indicate uncertainty about production assumed i.i.d

The expected sign for each parameter is α1-α7> 0; β1 - β7> 0; and γ1- γ7> 0. Estimation models were calculated using maximum likelihood estimation (MLE). The stages of analysis conducted to model production function, risk function, and the function of technical inefficiency, (Kumbhakar, 2002, 2010 and Nurhapsa Elys Fauziah, 2013) are as follows:

1. Estimate by:

   a. Regression y with respect to x and get the residual value (e) using OLS
   b. Looking for valueσ_μ^2using formulaσ_μ^2= (r-1+2/π)-¹ Wherer = $[(\frac{m_2^{3/2}}{m2})\ (\sqrt{\frac{2}{\pi}}\ )\ (1-\ \frac{4}{\pi})]$ and m is the central moment of the residual value (e)
   c. If the valueσ_μ^2already obtained the values of a, b and c can be obtained by using formulas:

   $.a=\sqrt{\frac{2}{\pi}}\sigma u$; $b^2 = \frac{(\pi-2)}{\pi}\sigma_\mu^2$; and $c = \sqrt{\frac{2}{\pi}}\,(\frac{4}{n}\text{-}1)\ \sigma_\mu^2$

2. Estimating technical inefficiency function by way of regressing | 0 | to q (x) √ ((1 + b²)) using method of maximum likelihood. The results of estimation of technical inefficiency can not be used to explain influence of these inputs to the technical inefficiency. Due to technical inefficiency is influenced by socio-economic factors such as size of land holdings, total household income, dependency ratio, age, education, experience and so forth farmingMengestimasi fungsi produksi dan efek inefisiensi teknis dengan cara meregresikan $(\frac{y}{a(x)} + a) = \frac{xi}{a(x)}$ where

   a = $\sqrt{\frac{2}{\pi}}\sigma u$ with*maximum likehood Method*.
3. Calculate the value of technical efficiency TI = $\frac{Ui.q(xi)}{f(xi)}$ where Ui = $\frac{\gamma i.q(xi)}{q(xi)}$
4. Estimate the risk function in a way meregres vi = ei - ui to g (x) with maximum likelihood method.
5. Estimate the parameters contained in the use of formula Ө

$$=(\frac{-AR.g(xi)-DR.g(xi).a}{1+AR.q(xi).a+\frac{1}{2DR}.g^2(xi)+q^2(xi)(b^2+a^2)})$$

$$\lambda = (\frac{a+AR.q(xi).(b^2+a^2)+\frac{1}{2}DR\ .(q(xi).a+q^2(xi)(c+3a^2b+a^2)))}{(1+AR.q(xi).a+\frac{1}{2DR}.(g^2(xi)+q^2(xi)(b^2+a^2)))})$$

where μη = f(x,z) – w.x;AR = -U*(μη) / U* (μη) ; DR = U*(μη) /(μη) farmers risk selection criteria are:

   a. If Ө = 0 and λ = 0 then the farmers are natural risk against risk
   b. If Ө <0 and λ> 0 then the farmers are averter against risks
   c. If farmers in full efficiency (u = 0) then the risk behaviors of farmers is determined by Ө
   d. If Ө> 0 and λ <0 then the farmers are risk takers

6. The level of technical efficiency obtained from fourth stage of data processing is used to calculate level of technical efficiency using formula TE = 1-TI.

Analysis of the sources cause technical efficiency using technical inefficiency effects model developed Battese and Coelli (1995) in Coelli *et al* (1998).

TI = ς0 + S2Z2 +S3Z3 + S4Z4 + S5Z5 + Wi …………… (2)

Where:

T_I : value of technical efficiency
Z_1 : Extensive land holdings (ha)
Z_2 :Total household income from on-farm, off-farm and non-farm activities (Rp / month).
Z_3 : Age, measured in rice farming year (year)
Z_4 : Education, measured in the length of formal education of farmers (years) Dependency ratio (vote)
Z_5 : Farming experience, measured in length
Z6 : Dependency ratio (soul).
Z7 :Distance home - land (m).
Z8 : Membership in farmers' groups.
Wi : Random error term that is assumed to be free and truncated normal distribution with N (0.o²).

The expected sign for each parameter Si inefficiency effect until S4 is negative while the S5 is expected to be positive.
One-sided statistical tests generalized likelihood ratio for inefficiency effects is calculated by equation:

LR = n ………………………………………………(3)

Where L (H0) and L (H1) are the values of the function of the likelihood that the null hypothesis and the alternate hypothesis. LR test criteria is if LR error (table kodde and palm), then reject H0 and if LR (table kodde and palm) then accept H0.

RESULTS AND DISCUSSION

Stages of analysis begins with Chow test to determine the regression coefficients there are similarities between four groups of data or observations. Based on the results obtained Chow test analysis calculated F value of 2,843 and value of F table with 9 and df 166 at level α = 5 percent by 2:01. So that H0 and H1 accepted, meaning that there is a regression coefficient differences between four groups of observations because value of F is greater than value F table. Therefore, the function of productivity, risk function of productivity, technical efficiency and productivity of farmers' risk behavior analysis is combined so that it will produce a correct conclusion.

Productivity Frontier Function and Risk Function Productivity

Models with stochastic frontier estimation methods Maximum Likelihood (MLE) is done through a two stage process. First stage using Ordinary Least Squares (OLS) to estimate parameters of technology and production inputs. The second stage using MLE method to estimate overall production parameters, intercept, and the variance of the error components v1 and u1.

Production Function Estimation Method of Ordinary Least Squares

The production function describes transformation of inputs into output combination that shows minimum number of inputs to produce a given output. Parameter estimation Cobb-Douglas production function with OLS provides an overview of the performance of average farmer's production process at the level of the existing technology. Results estimates a production function against four groups of observations are presented in Table 1. Table 1 shows that production function formed quite good (best fit) describes behavior of farmers for example in production process. Estimation results indicate that diversity of rice production can be explained by diversity of inputs by 80.3 percent. The variables that significantly affect production at level of α = 0.01 is the land (X1), fertilizer N (X3), and labor (X6). Seeds (X2) and growing season (DX9) significantly affect production at the level of α = 0.05. While fertilizer K (X5), fertilizer P (X4), organic fertilizer (X7), and insecticide (X8), significantly affected the production at α = 0.15.

Estimation of land variable (X1) real and positive effect on the average yield of paddy rice. This variable has a value of elasticity of 0.4875. It shows once the extent of cultivated land plus 10 percent, the increase rice production by 4.87 percent, in the conditions of use of other inputs remain. The results of this study are consistent with Tadesse and Krishnamoorthy (1997), who found that the size of the land significantly affect the level of rice production in Tamil Nadu, India. Nunung Kusnadi *et al.,* [2011], the variable land most responsive compared to other variables because it has the greatest elasticity. The implication is that if farmers want to increase production, then the variable land that should be a major concern.

Fertilizer N (X3) has significant effect on increasing production. The use of nitrogen fertilizers in general is still below the recommended dose. So the addition of nitrogen fertilizer they can improve their results. P fertilizer use on average is still below the recommended dosage. Fertilizer P (X4) showed no real effect on rice production. There are theoretical reasons that can explain the effect of P fertilization on production. Name of land in the district of West Tanjab is ultisol which included the old ground. The content of iron and aluminum in soils relatively many old, so the P fertilizer applied to the soil to be much bound by iron and aluminum in the soil. AJ-P bond and FEP is difficult to decompose, resulting crop shortages P. K fertilizer use (X5) significantly affect the average production. This means that the use of fertilizer K needs to be improved to increase rice production some farmers are relatively high. Labor (X6), has elasticity which is equal to 0.3872 and no real effect on rice production. The use of labor is widely available on the activities of planting and harvesting rice paddy using labor from outside the family with a piece rate system. Lack of farm workers who are willing to help the completion of the work led to farmers willing to pay wages in a high enough price.

Use of organic fertilizers (X7) significantly affect the average production. This means that the use of organic fertilizers need to be improved so that the results obtained may be increased in the production of paddy rice farming. So is the use of chemical insecticides (X8) significantly affected the production of paddy rice farming, the use of the appropriate dose in the use of insecticides, so the production can be increased. Variable planting season (DX9), showed an elasticity of 0.1416, this case shows that the influence of the growing season positive effect on rice production. During the dry season rice farming is inefficient due to the lack of water. This means that water availability is critical in rice farming so that government policy can be directed to the improvement and development so as to improve the efficiency of irrigation rice farming.

ble 1. Estimation results Cobb-Douglas Production Function by Using Ordinary Least Squares Method

Input Variabel	Kerinci	Sarolangun	Bungo	Tanjabtim	Province (mix)
Constants.	2.3152	1.9565	1.7612	1.6433	1,8667
Land (X1)	0.7346[a]	0.3641[b]	0.4364[a]	0.4667[a]	0,4875[a]
Seed(X2)	0.1554	0.295	0.0970	0.1042	0,1134[b]
Fertilizer N (X3)	0.1012	0.0972	0.1031[a]	0.0992[b]	0,1987[a]
Fertilizer P (X4)	0.0025	0.0006	0.0028	0.0028	0,0026[c]
Fertilizer K (X5)	0.0027	0.0041	0.0047[a]	0.0047[b]	0,0036[c]
Labor (X6)	-0.1855	0.7387[a]	0.3775[a]	0.3227[b]	0,3872[a]
Organic fertilizer (X7)	0.0045	0.0066	0.0124	0.0027	0,0171[c]
Chemical insecticides (X8)	0.0014	0.0018	0.0025	0.0020	0,0143[c]
Planting season (dX9)	0.1365	0.1570	0.1675	0.0985	0,1416[b]
Adj-R^2	80.02	80.9	79.9	79.4	80,3
F value	23.91	32.04	52.81	44.98	46,74

Description: a, b and c flame at the level of α = 0:01, 0:05, 0:15

Productivity Frontier Function Estimation Methods Maximum Likelihood Estimation (MLE)

This study uses a model specification function productivity frontier, risk function of productivity and functionality of technical inefficiency developed by Khumbakar (2002) ,because it can be used to analyze impact of inputs on productivity, impact of the allocation of inputs to risk of productivity, technical efficiency and behavior of producers in the face of risk of productivity. The estimation results of frontier productivity functions, risk functions in productivity can be seen in Table 2 and Table 3.

Table 2. Productivity Function Estimation Results frontier with MLE method on Rice in Jambi

Variabel	Koefisien	Standar Error	T hitung
Production functions			
Constans	1,3585	0,1986	6,8403
Seed	0,4246	0,0986	4,3062[a]
Fertilizer urea	0,7256	0,2750	2,6385[a]
Fertilizer SP 36	0,4542	0,1667	2,7246[a]
Fertilizer KCl	0,2944	0,0824	3,5728[a]
Organic Fertilizer	-0,1345	0,1435	-0,9372[c]
chemical insecticides	0,1167	0,0350	3,3342[a]
Labor	0,0864	0,4333	0,0194[c]
LR	31,82		

Description: a, b and c noticeable at the level of α = 0:01, 0:05, 0:15

Table 2 shows that the estimation function of productivity frontier that the coefficient of determination [R2] of 0.7845, this means that 78.45 percent of the variation of the productivity of paddy rice can be explained by the variation of independent variables in the model, in other words, 78.45 percent are independent variables together affect the productivity and the remaining 21.55 percent influenced by other variables not included in the model. In partial variable seed, fertilizers and chemical insecticides KCl significant effect on the level of α = 0:01, urea and fertilizers variable SP 36 significant effect on the level of α = 0:05 to productivity. The elasticity of the productivity frontier of variable seed, fertilizer urea, SP 36 fertilizer, organic fertilizer, fertilizer KCl, chemical insecticides and labor at 0.4246, 0.7256, 0.4542, 0.2944, -0.1345, 0, 1167, and 0.0864. if the seed, labor, fertilizer urea, SP 36 fertilizer, organic fertilizer, chemical fertilizers and insecticides KCl plus 10 percent assuming ceteris paribus, it can increase the productivity of each of 4.246, 7.256, 4.542, 2.944, -1.345, 1.167 and 0.864 percent.

The variables that significantly affect production at the level of α = 0.01 is the seed, fertilizer urea, SP36, KCL fertilizer and chemical insecticides. While organic fertilizer and labor significantly affect production at α = 0.15. The addition of seed they can improve productivity. Conditions in the area showed that the use of seeds have not been optimal and their variations farmers spacing is 15 x 15 cm, 20 x 15 cm, 17.5 x 15 cm. Moreover, most farmers do not carry out replanting seedlings. Their variation and replanting seedlings planting distance will affect rice production variations. The use of seed per hectare in the study area is 17.6 kilograms. Use of the seed is still below the recommended dose as much as 20-30 kilograms per hectare (BPTP Jambi, 2010). These results differ from the results of research conducted by Prasiska [2007] which shows that the average use of seeds in rice farming in Karang Anyar district was 52.53 kilograms per hectare,

The addition of urea fertilizer can still increase rice productivity. Conditions in the study area showed that the average price of urea fertilizer use in rice is 65.5 kilograms per hectare. The use of urea in the research area is still below the recommended dose of BPTP Jambi Province is 150-250 kilograms per hectare. SP 36 fertilizer additions significantly increase the productivity of rice farming. Average fertilizer use SP 36 is 37.6 kilograms per hectare. Dosage KCl Fertilizer and chemical insecticides used by farmers depends on the brand used. Increasing the amount of KCl fertilizer and insecticide use aims to protect plants from pests and diseases that often attack rice plants in the growth phase or during the rainy season. Average KCl fertilizer use by farmers of respondents was 26.5 kilograms. While the average use of chemical insecticides is 5.65 liters per hectare. Unlike the recommendation BPTP Jambi [2010] that the average use of fertilizers and insecticides KCl by rice farmers in Jambi Province is 100-150 kg per hectare and 10.5 to 16.8 liters per hectare for chemical insecticides. Extra labor is still able to increase the productivity, but not significantly. This shows that the use of labor is not optimal. Average employment was 95.66 HKSP. Allegedly this was due to labor all make much more than in families that have a level of technical skill which is still low compared to labor outside the family. The results of this study is different from the research conducted by Prasiska [2007) who showed an average use of labor in rice farming ranging from land preparation to harvest in Karang Anyar district is 120.50 to 145.30 HOK / ha.

Productivity Risk Function Estimation Methods Maximum Likelihood Estimation (MLE)

The estimation results of next frontier productivity functions used as a basis for estimating the risk function of productivity. The estimation results of the functions of production risks can be seen in Table 3.

Table 3. Risk Function Estimation Results Productivity with MLE method on Rice in Jambi

Variabel	Koefisien	Standar Error	T hitung
Production Function			
Constans	-208,385	94,875	-2,1964
Seed	12,456	5,766	2,1602[a]
Fertilizer urea	1,893	4,211	0,4495
Fertilizer SP 36	2,756	4,867	0,5662
Fertilizer KCl	2,451	3,112	0,7875
Organic Fertilizer	-14,833	7,125	-2,0818[a]
chemical insecticides	-0,356	0,744	-0,4784
Labor	-16,062	6,325	-2,5394
LR	27.56		

Description: a, b and c noticeable at the level of α = 0:01, 0:05, 0:10, 0:15

Table 3 shows that the magnitude of the coefficient of determination [R2] of 0.5345, this means that as many as 53.45 percent of paddy rice productivity can be explained by the variation of independent variables in the model, with 53.45 percent of the independent variables jointly affect the productivity and the remaining 46.55 percent influenced by other variables not included in the model. Results of the analysis showed that the risk function productivity of seeds, labor, and organic fertilizers significantly affect the risk of productivity at the level of α = 0.05 and α = 0:10 in the farms.
The results of the variable coefficient estimate of seed, fertilizer urea, fertilizers and fertilizer KCl SP 36 is positive on the farm. A positive sign of the coefficient of the coefficient indicates that the input output is input that can increase the risk of increasing productivity or risk. While the coefficient of the coefficient of labor, organic fertilizers and chemical insecticides are negative. The negative sign of the coefficient indicates that the coefficient is input input input input which lowers the risk or the risk of decreasing.

The addition of organic fertilizer can reduce productivity, but not significantly. The results are consistent with research conducted by Qamaria (2011) which shows that the use of organic fertilizers and no real negative effect reduce productivity in farming taro in Bogor. This is presumably because the organic fertilizer used by farmers through further processing to accelerate the decomposition of organic matter. In addition, it is also thought to be caused due to limited capital owned by farmers that organic fertilizer is often not timely. This is in line with research Nainggolan (2011) which concluded that the capital constraints caused most farmers use organic fertilizers under the recommended dosage on rice farming in Tanjabbar Jambi Province. Average use of organic fertilizer is 850 kilograms per hectare. Doses used by farmers still below the recommended dose is 5000 - 7000 kilograms per hectare (BPTP Jambi, 2010). The estimation results of the productivity frontier function (Table 3) show that KCl fertilizers and chemical insecticides and real positive effect on productivity. The addition of seed significantly increases the risk of productivity. On the other hand the results of the analysis of the function of productivity frontier shows that the addition of seeds significantly increase productivity. But the addition of the seed can also affect the productivity of rice variety. The addition will increase the risk of seed paddy production is suspected because the farmers use seeds purchased from vendors in the market and is not superior (generation of seeds is not clear). The results are consistent with research conducted Qamaria (2011) which shows that the seeds increased the risk of productivity of taro in Bogor. This is because generally taro farmers use seeds purchased from vendors in the market that quality is not good. Addition of Fertilizer SP 36 did not significantly increase the risk of productivity. The results showed that the use of fertilizers SP 36 is still below the recommended dosage. The inability of farmers to provide fertilizer SP 36 in amounts as recommended due to limited capital owned by farmers and difficult to access capital loans to financial institutions.

The estimation results indicate that the risk function Fertilizer KCl productivity significantly increases the risk of productivity. Dose KCl fertilizer use in rice farming in the area of research tailored to the doses listed on the brands digunkan. Average fertilizer use KCl 26.6 kilograms per hectare. In contrast to the recommendations of the BPTP Jambi (2010) that the average use of fertilizers KCl in rice farming is 100-150 kilograms per hectare, The addition of organic fertilizers significantly reduce the risk of productivity. These results indicate that the organic fertilizers are inputs that decrease the risk (risk decreasing). The average respondent farmers use organic fertilizers are still below the recommended dose of 850 kilograms per hectare. Being recommended is 5000 - 7000 kilograms per hectare. The results are consistent with research conducted by Nurhapsa [2013] which showed that the addition of organic fertilizers significantly reduce the risk of potato productivity in Enrekang South Sulawesi Province. According to Rachman [2006] that organic fertilizers can function in terms of; [1] gatra improving soil fertility and increased production, as organic fertilizer containing all macro and micro nutrients needed by plants and contain growth hormones that can stimulate plant growth, [2] gatra environment in maintaining the balance of the ecosystem, because it improves soil structure so that aeration in ground the better, improve cation exchange capacity to nutrient elements contained in the soil readily available to the plant, increasing the ability of soil to retain water and prevent the loss of nutrients from the soil as a result of the washing process water from rain or irrigation water, [3] gatra economy will save money State foreign exchange to import fertilizer, agricultural chemicals and provide more employment opportunities and improve the income of farmers.

The addition of chemical insecticides are not noticeably reduce the risk of productivity. Chemical insecticides adjusted to doses listed on the brand used. Average use of insecticides 2:26 liters per hectare. In contrast to the results of research Suharyanto et.al (2012) that the use of pesticides significant effect on decreasing the risk of rice production. It is also obtained from the research Villano and Fleming (2006), that the use of production inputs of herbicides affect rice production to reduce the risk. Results of field observations in the face of the risk of production of farmers preventive action against pests and diseases. The addition can reduce the risk of labor productivity (Table 3). These results indicate that the labor input is the risk of decreasing input. So if farmers want to increase productivity by increasing labor productivity will decrease the risk. This can happen because the labor supply is sufficient, the farming activities will be put right so that the risk of failure caused by labor shortages can be avoided. The results are consistent with research conducted by Fauziyah (2010) which showed that the addition of labor significantly reduce the risk of tobacco farming productivity in the mountains with a self-help system in the District Pakong, Pamekasan. With the input of information about the input that increases the risk (risk incresingi) and a reduced risk (risk decreasing) then it will assist farmers in managing their farming or in the management of production.

Technical efficiency Farming

Technical efficiency is a reflection of the ability of the company to get maximum output from a set of inputs available. Defined as the ratio of actual production from farmers at a technical level the possibility of maximum production. This research analyzes the technical efficiency can be measured by using the following formula:

Ti = E [exp (-Ui) / εj] i = 1,2,3, ... N

Where TEI is the farmers' technical efficiency to-i. Exp (-E [Ui [εi]) is the expected value (mean) of Ui with the terms εi, so 0 ≤ TE, ≤ 1. The value of technical efficiency is inversely related to technical inefficiency effects and is only used for a function that has a number of output and certain inputs (cross section data). The value of farmers' technical efficiency is categorized quite efficient if it is worth> 0.7 and categorized yet efficient if worth ≤ 0.7. Sumaryanto (2003), suggests that the level of technical efficiency can be interpreted double-faced. On the one hand, a high level of efficiency which reflects the achievements of farmers in managerial skill is high enough. Mastery of information and decision making in managing critical factors that affect farm productivity performance can be judged to be at a satisfactory level. On the other hand, a high level of efficiency also reflects that opportunities to increase productivity is quite high because the smaller the gap between the level of productivity that have been achieved with the maximum level of productivity that can be achieved with the best management system (the best practiced) is quite narrow. This means that in order to increase farm productivity required significantly more advanced innovations that require breakthrough technology derived from research activities. As for the distribution of technical efficiency usahatan rice in Jambi Regional Table 4.

Table 4. Distribution of Technical Efficiency of Farmers Example

Hose Efficiency	Indeks efisiensi		
	Balance (n)	Percen (%)	Overal
0,4-0.5	12	6,81	0,4425
0.5-<0.6	40	22,72	0,5215
0.6-<0,7	79	44,89	0,6412
0.7-<0.8	25	14,20	0,7360
0.8-<0.9	17	9,66	0,8215
0.9-<1.0	3	1,70	0,9130
Total	176	100	
Overal	0,6218		
Minimum	0,4235		
Maksimum	0,9312		

Table 4 shows that the estimated parameters is the ratio of the variance of technical efficiency (u1) of the total variance of production (Σi). The value of y is 0.3935 means that 39.35 percent of the total rice production variations caused by differences of technical efficiency and the balance of 60.62 percent due to the effects of stochastic frontier. Results The estimated of generalized likelihood ratio (LR) of the stochastic frontier production function that has a value greater than the value of y2 distribution table gives information that there are significant efficiency and farmers' technical efficiency in the production process. Technically efficient distribution of the models used are presented in Table 4. The average level of technical efficiency achieved sample farmers in the farming of paddy in the location of research is 0.6218. means the average productivity achieved is about 93 per cent of the frontier that maximum productivity can be achieved with the best management system (the best practice). The efficiency rate was classified as a category was for not approaching the frontier (TE-1). The level of technical efficiency is being reflected on managerial skills of farmers are not high enough. But the level of efficiency was also suggests that opportunities to improve productivity even greater because the productivity gap that has been achieved with the maximum level of productivity that can be achieved with the best management system is quite large. Paddy rice farming in Jambi province still has an opportunity to increase productivity in the short term amounting to 37.82 per cent by way of optimizing input farming. The rest needed technological innovation and improvement of farm management. The average value of technical efficiency of farmers by district sample data are presented in Table 5 below.

Table 5. Distribution of Technical Efficiency of Farmers Based Sample Sample District Farmers Using Stochastic Frontier Production Function

Technic Efisiensi	Balance of Famer (%)			
	District Kerinci	Sarolangun	Bungo	Tanjabtim
0.5-<0.6	11,11	17,78	15,00	19,57
0.6-<0,7	35,56	57,78	67,50	60,87
0.7-<0.8	37,78	22,22	15,30	19,56
0.8-<0.9	8,89	2,22	2,50	-
0.9-<1.0	6,66	0,00	-	-
Overall	0,7165	0,6445	0,6310	0,6012
Minimum	0,5235	0,5072	0,5164	0,5034
Maksimum	0,9342	0,9035	0,8215	0,7460

Table 5 shows that farmers instance Kerinci Region has an average technical efficiency is higher than other farmers in Jambi Regional. The results of estimation of technical efficiency is higher in Kerinci Local farmers compared to other regions due to the level of input use real better so that the resulting higher productivity .Rata average technical efficiency at farm level is 0.6483. this shows that the average productivity of farmers reached about 64.83 percent of the marginal productivity (frontier), efficiency of use of inputs in the production process can be improved to reach the frontier of about 35.17 percent. The efficiency rate was classified as a low category because away from the frontier (TE = 1) and the magnitude of TE = 0.6483, therefore the value of farmers' technical efficiency categorized as low if the technical efficiency is said to be efficient if the value of TE> 0.70. Low level of technical efficiency reflects the managerial skills of farmers is low. But the low level of efficiency also suggests that opportunities to improve productivity even greater because the productivity gap with the level of productivity achieved the maximum that can be achieved with the best management system is quite large. The results of the technical efficiency analysis also showed that the lowest level of technical efficiency to farmers is 0.5 - <0.6 with an average efficiency rate of 0.4425 by the number of farmers as much as 6.81 percent and the highest is 0.9 - 1.0. Farmers as much as 1.70 percent of respondents who achieve technical efficiency average of 0.9130, as much as 67.61 percent of respondents farmers who achieve technical efficiency average of 0.5675 and the remaining 23.86 percent of respondents farmers who achieve technical efficiency between 0.70-0.89 with average technical efficiency 0.7586. Policies to increase productivity through technical efficiency can be done on certain groups through participatory information system is that farmers are quickly adopting the use of new technologies, especially in the use of input in accordance with the recommendation.

Sources of Technical Inefficiency Farming

The use of low input levels below the recommendation would result in lower Return to scale. Farmers faced with the question of the optimal combination of inputs used. Factors that could limit the achievement of maximum results referred to irregularities in farming. Deviations from the frontier Isoquant called technical inefficiency. There are many factors that influence the failure to achieve technical efficiency in the production process. Pinpointing the source of inefficiency and provide information about the Suber-potential sources of inefficiency and give suggestions for the policy to be applied or removed to achieve a total efficiency level. The estimation results of the sources of technical inefficiency of rice farming can be seen Table 6.

Table 6. Results Estimates Sources Technical Efficiency of Rice in Jambi Province

Variabel	Koefisien	Error Standart	T value
Effects of technical efficiency [1]			
constans	2.305	1.177	1.959
Land (Z_1)	0,254	0,0287	8,85[a]
Total revenue (Z_2)	-0,410	0,0157	-26,114[a]
age(Z_3)	0.092	0.059	1.567[c]
Knowledge(Z_4)	-0.067	0.147	-0.458[d]
farming experience (Z_5)	-0.289	0.122	-2.366[a]
Dependency ratio(Z_6)	-0.511	0.433	-1.181[c]
Distance land-house (Z_7)	0.003	0.001	-2.256[a]
Farmers(Z_8)	-0,1671	0,1208	-1,3832[b]

Description: a, b, c and d real on the level of α = 0:01, 0:05, 0:10 and 0:15

Table 6 shows that in the estimation model of technical efficiency was found to problems of technical inefficiency in production of rice in the amount of 35.17 percent. This is presumably because there are some internal factors derived from social and economic characteristics that become sources of technical inefficiency. Therefore analyzing the sources of technical inefficiency on rice farming for Jambi Regional. Table 6 shows that the factors that significantly and become the determinants of technical inefficiency in the production process of rice farming is a land area (Z1), the total income (Z2), the experience of farming (Z5), and the distance of the land - the house (Z7) with a level confidence α = 0.01. Significant with a confidence level α = 0.05 is farmer groups (Z8). Age and dependency ratio significantly affected the production with a value of α = 0.10. As for education (Z4), significantly affected the production with a value of α = 0.15.

Land held (Z1). The land area and no real positive effect on the technical inefficiency. A positive sign in the variable land shows that farmers who have a narrow field, relatively more efficient than the farmers who have large land, but the land area variable in this study had no significant effect. If farmers have better managerial capacity and adequate capital in farming, smallholders and farmers with large tracts of land would have the same efficiency. Several studies like Tadesse and Khrisnamoorthy (1997), Herdt and Mandac (1981), Ogundari and Ojo (2006) obtain results in line with this research. Small to medium scale farming was more technically efficient than farming land area. This is due to the dependence on the condition of financial institutions to finance farming, small-scale farming while trying to allocate their resources effectively. Total Revenue (Z3), the income of farm households and real example of a negative effect on the technical inefficiency paddy rice farming. This is due to the income of farm households was positively correlated with the ability of farmers to provide capital for farming. Ability capital increase will facilitate the farmers to buy inputs in amounts according to recommended dosage, better quality, and timely. Research Kalirajan (1990) in the Bravo ureta and Pinhero (1993), the rice farming in the Philippines also found that revenue from outside the farm into the factors affecting technical efficiency. While Villano and Fleming (2004) found different things, namely off-farm income from it will cause the horse farm to be inefficient due to the activities of members of the family farm more are outside the farm.

Variable age (Z4) and real positive influence on the technical inefficiency. This means that the older the age of farmers is increasing, the technical inefiusiensi or in other words young farmers aged more efficient technique as compared with the farmer enough old. This can be explained that along with the aging of farmers, who possessed the ability to work, fighting spirit in the effort, the desire to bear the risk and the desire to implement new innovations are also increasingly berkutang so the impact on the work efficiency. Conditions in the area of research shows that the average age of farmers respondent is still at the productive age range is 32-58 years who still has particularly strong ability to work so as to reduce technical inefficiency on the farm.

The results are consistent with research Fauziyah (2010) and Saptana (2011) Nurhapsa [2013]. But unlike the research conducted by Muslim (2012) which showed that age and a real negative effect on the technical inefficiency of rice farming in the province of South Sulawesi. Variable formal education (Z5). The level of education is negative and does not significantly affect the technical inefficiency. Berpengaruhan lack of education in this study due to the farmer example has considerable experience long farming rice paddy fields so that farmers are able to apply the example of existing technology in farming. These results are consistent with research Kebede (2001) and Sumaryanto *et al.,* (2003), which found that education has positive influence on technical efficiency of rice farmers, but unlike the research Tanjung (2003) who found that education negatively affect technical efficiency of farming potatoes. Variable farming experience (Z6). Experience farmers examples of negative and not significant to technical inefficiency. That is, the more experienced farmers more efficient in production, especially in the use of production inputs. The same is obtained by Kalirajan (1984), Kalirajan and Shand (1986) in the Bravo-Ureta and Pinheiro (1993) in the State Philippines and India who found the experience positive effect on rice production technical inefficiency. Berpengaruhan lack of experience due to the experience that farmers in the study sample was relatively similar and farmers tend to be influenced by culture tillers less attention to aspects of plant maintenance. Dependency Ratio (Z2). Figures dependence significantly and adversely technical inefficiency. The higher the ratio between family members who are not working and working, the farmers are more efficient. These results indicate that farmers with more number of dependents, relatively more efficient than the farmers who have little number of dependents. This relates to the use of family members as labor in the family. These results are consistent with the results Bravoureta and Pinheiro (1997), that the dependency ratio adversely affect the efficiency and technical inefficiency.

The analysis showed that the negative effect and a real extension of the technical inefficiency. That is, the extension can eliminate constraints in using the technology of production inputs at the right time and can improve the technical efficiency of farmers. These results sejalam with Hartoyo study (1996), which states that education has positive influence on technical efficiency. Variable dependency ratio negatively affect the technical inefficiency farming. This shows that the dependency ratio, which is a source of labor in the family can replace the workforce outside the family hired. The use of labor in the family who is accompanied by efforts to improve the technical skills and managerial capabilities potentially reduce technical inefficiency farming. The results are consistent with research conducted by Saptana (2011), which shows that the ratio of the number of household members of working age to total household members but no real negative effect on the technical inefficiency curly red chili farming in Central Java province. Similarly, research Prayoga (2010), which shows that the productive age dependency ratio significantly decrease the inefficiencies of organic rice farming in paddy fields in Sragen, Central Java. Labor in productive age can reduce the use of labor input outside the family hired to manage the farm.

The distance of land with a farmhouse respondents positive and real good on the farm. The closer the typical farm with the farmer's house technical efficiency is increasing. These results are in line with expectations closer to home usahtani land farmer, inefficiency getting down. The results of this study are not consistent with research Muslimin (2012), which indicates that the distance farm with the farmer's house and a real negative effect on the technical inefficiency paddy rice farming in the province of South Sulawesi. This means that the greater the distance of typical farm with farmer households getting down the technical inefficiency.

Farmer groups, the analysis results indicating that the extension of farmer groups and a real negative effect on the technical inefficiency. This means that agricultural extension can eliminate constraints in using the technology of production inputs at the right time and can improve the technical efficiency of farmers. These results are consistent with research Asnah et.al (2015), that increase in technical efficiency is still possible with a more active participation of farmers in extension activities.

Farmers Risk Behavior Productivity

The achievement of efficiencies related to capabilities and behavior of farmers in use of inputs in farming. On the other hand use of inputs associated with risk of farming which in turn create a farmer's behavior in face of the risks of farming. In fact, the behavior of farmers in face of the risk of productivity is very influential in the decision making allocations of input and influence on output deals. According to Ellis (1988), the behavior of farmers against the risk grouped into three, namely: (1) those who avoid risk (risk averse), (2) those neutral towards risk (risk neutral), and (3) those who like risk (risk taker). The risk behaviors productivity of farmers in rice farming can be seen in Table 7.

Table 7. Farmers At Risk Behavior Rice Productivity in Jambi Province

Production Input	Average value θ	Average value of λ	Productivity risk behavior
Constans	-0,135	1,434	*Risk Averse*
Seed	0,000	0,000	*Risk Neutral*
Fertilizer urea	-1,644	0,788	*Risk Averse*
Fertilizer SP 36	-0,876	0,563	*Risk Averse*
Fertilizer KCl	0,014	2,334	*Risk Averse*
Organic Fertilizer	0,033	0,685	*Risk Taker*
chemical insecticides	-6,455	0,824	*Risk Averse*
Labor	0,356	0,875	*Risk Averse*
Overall	-1,153	0,938	*Risk Averse*

Table 7 shows that the average value of θ farmer is -1.153 and the average value of λ is 0938. These results indicate that the average productivity of farmers' risk behavior to the inputs of production inputs is to avoid the risk (risk averse). That means that if there is an increase range of profits or income the farmers as decision makers and compensate by lowering profits or expected revenue. Risk behaviors productivity of farmers on inputs of seeds, labor, fertilizer urea, organic fertilizer, manure and chemical insecticides SP 36 is to avoid the risk (risk averse). This means that rice farmers are afraid or do not dare behave allocate inputs of seeds, labor, fertilizer urea, SP 36 fertilizer, organic fertilizers and chemical insecticides in larger quantities. So the use of these inputs in a larger amount on his farm to obtain higher production. Risk behaviors productivity of farmers on seed are risk averse (Table 7). The results are consistent with research conducted Fariyanti (2008) which indicates that risk behavior and productivity of rice farmers in the District Panagalengan cabbage, Bandung regency. Risk behaviors productivity of farmers who avoid risk (risk averse) tend to use lower input than the farmer who dared to risk. This is indicated by the use of seed which is still below the recommended dose is an average of 17.5 kilograms per hectare while the recommended dose of 25-35 kilograms per hectare (BPTP Jambi, 2010). The use of seed which is still below the recommended dose resulted in productivity achieved farmers is still low. Risk behaviors productivity of farmers on urea fertilizer inputs are risk averse or do not dare to risk the productivity (Table 7), so that the allocation of urea fertilizer use is still low. The use of urea is 65.5 kilograms per hectare were recommended dose is 200-300 kilograms per hectare. The results are consistent with research conducted Fariyanti (2008), which showed that the rice farmers and cabbage in Pangalengan, Bandung regency behaved risk averse against urea. Fauziyah Research (2010), also show that the behavior of farmers on fertilizer urea is risk averse on tobacco farming in dry land with a system of partnership in the District Prohibition, Pamekasan. In contrast to research conducted by Saptana (2011), which indicates that the behavior of great chili farmers in Central Java province on fertilizer N is a risk taker. Saptana research results (2011), also stated that the fertilizer N is greater in large chili caused by fertilizer N is the main fertilizer is crucial in the success of large chili farming.

Risk behaviors productivity of farmers on organic fertilizers are risk averse. So that the average allocation of organic fertilizer use is still low at 850 kilograms per hectare is being suggested is up to 5000-7000 kg per hectare. Whereas the results of the risk estimation shows that the productivity of organic fertilizers significantly reduce the risk of paddy productivity. Therefore, the addition of organic fertilizer use is still allowed because it can reduce the risk of productivity. The low use of organic fertilizers in farming due to farmers have limited capital to purchase the inputs. The results of this study are consistent research Fauziyah (2010), which indicates that risk behavior productivity tobacco farmers are risk averse towards organic fertilizer on dry land with a system of partnerships and non-wetland system in the District Prohibition, Pamekasan.

Risk behaviors productivity of farmers on fertilizer KCl is a risk taker or risk-taking. The use of fertilizers KCl more to prevent or reduce pests and diseases, so the risk of crop failure can be reduced. Generally, farmers are using fertilizers KCl more on plant pests and diseases or during the rainy season, so it can reduce the risk of productivity. Behavioral risk of chemical insecticides farmers are risk averse, and are dependent on the perception; [A] the higher the perception of farmers against the risk, the more chemical insecticides are used, [b] the lower the resistance of a variety to pests and diseases, more and more chemical insecticides used by farmers, and [c] the lower the knowledge of farmers on the dangers more chemical insecticides used by farmers. In contrast to research conducted Saptana (2011) which showed that the behavior of red chili farmers in Central Java province to the pesticide / fertilizer KCl is risk neutral. Risk behaviors farmer productivity in labor input also avoids the risk (risk averse). This means that farmers dare not allocate labor input in greater numbers in farming. This is shown by the average labor HKSP 180.52. The results are consistent with research Fauziyah (2010) that behavioral risks of tobacco farmers manufacturing productivity in paddy fields with self-help system in the District Pademawu, District Pamengkasan the workforce is risk averse. The same is shown from the results Fariyanti (2008) that rice farmers and cabbage in District Canning, Bandung regency behaved risk averse to labor input.

In the area of research Patani respondents behave in fear of the risks so as to reduce the risk of productivity, there are 65 percent of the farmers of respondents do cropping pattern of rice-crops-rice, 30 percent of farmers respondents made rice-fallow-rice and there were 5 percent of the farmers to diversify crops, in addition to seeking rice farmers also cultivate other crops in each planting season.

Conclusion

Use of inputs used in rice farming is not optimal seen from the productivity of rice farming has not optmal. This reflects the low productivity of farmers in the achievement of managerial skills are quite low. Technical efficiency achieved in the category of farmers are quite low. The use of inputs is not optimal to reflect that opportunities to improve technical efficiency is still quite high due to gap between the level of technical efficiency has been achieved with the maximum efficiency level that can be achieved with the best management of [the best practiced] big enough. Technical inefficiency is affected by total revenue, experience, education, dependency ratio, the distance of the land - the house and membership in a group of farmers with a negative and significant coefficient. This means that these variables can eliminate the technical inefficiency. Variable land and farmers aged significant positive coefficient. This means that a narrow area of land more efficiently and more efficient old farmer .. Behavioral risk and productivity of farmers is to avoid the risk (risk averse). Risk behaviors are risk averse farmers have implications for the allocation of input use. More and avoid the risk of productivity, the less the allocation of inputs used, so that the productivity achieved lower farmers. This is indicated by the allocation of use of inputs in farming paddy below the recommended dosage so that rice productivity is still low. Therefore, efforts to encourage farmers to increase productivity and so that the farmers do not avoid risk it is necessary: (1) the policy of increasing productivity by introducing modern technologies to farmers (2) mentoring by extension, increase energy agricultural extension so that farmers obtain education better and easily obtain information about the use of input optimal (3) add to the amount of capital assistance for farmers to undertake the guidance and supervision of the aid distributed (4) improving the network of partnerships between farmers, gapoktan, banks and other economies that can support the procurement of inputs, credit and marketing results.

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