Efficiency Analysis of Curly Red Chili in Tasikmalaya Regency

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ABSTRAK

Penelitan ini untuk mengkaji efisiensi usahatani cabai merah besar. Secara khusus, studi ini bertujuan untuk : (1) Mengetahui faktor- faktor yang mempengaruhi produksi cabai merah, (2) Mengetahui efisensi teknis, alokatif dan ekonomis, dan (3) Mengetahui faktor-faktor utama yang mempengaruhi ketidakefisienan dalam usahatani cabai merah keriting. Metode penelitian dengan pendekatan kuantitatif dan bersifat deskriptif. Penelitian deskriptif ini menggunakan metode survei dengan alat pengukuran berupa kuesioner. Penentuan lokasi penelitian ini dilakukan secara sengaja (*purposive sampling),* yaitu Kabupaten Tasikmalaya. Penentuan responden digunakan teknik *multistage random sampling*. Jumlah sampel sebanyak 48 petani. Metode analisis yang digunakan dalam penelitian ini adalah fungsi produksi *stochastic frontier* dengan menggunakan software eviews 7. Faktor faktor yang berpengaruh pada produksi usahatani cabe merah keriting adalah luas lahan, pupuk phoska dan pupuk NPK, sedangkan benih, pupuk kandang, TSP, insektisida padat, fungsisida dan tenaga kerja tidak berpengaruh nyata.Kegiatan usahatani cabe merah keriting secara umum belum efisien baik secara teknis (rata-rata 0,44), alokatif (rata-rata 0,424) maupun ekonomi (rata-rata 0,178). Faktor berpengaruh terhadap inefisiensi yaitu pengalaman petani, sedangkan usia dan pendidikan tidak berpengaruh. Hal ini disebabkan karena ketrampilan dan pengetahuan tentang ushatani cabe merah keriting didapatkan secara turun temurun.

Kata Kunci: cabe merah keriting, efisiensi, stochastic frontier

ABSTRACT

This research is to assess the efficiency of large red chili farming. Specifically, this study aims to: (1) Know the factors that influence the production of red chilies, (2) Know the technical, allocative and economic efficiency, and (3) Know the main factors that influence the inefficiencies in curly red chili farming. The research method uses a quantitative approach and is descriptive in nature. This descriptive study used a survey method with a measuring instrument in the form of a questionnaire. The determination of the location of this research was carried out purposively (purposive sampling), namely Tasikmalaya Regency. The determination of respondents used multistage random sampling technique. The number of samples is 48 farmers. The analytical method used in this research is the production function of the stochastic frontier using Eviews 7 software. Factors that influence the production of curly red chili farming are land area, phosphorus and NPK fertilizers, while seeds, manure, TSP, solid insecticide, functionicide. and labor has no significant effect. Generally, curly red chilli farming activities are not efficient either technically (average 0.44), allocative (average

0.424) and economic (mean 0.178). Factors that influence inefficiency are farmer experience, while age and education have no effect. This is due to the hereditary skills and knowledge of curly red chilli farming.

Keywords: *red curly chilies, efficiency, stochastic frontier*

INTRODUCTION

The productivity will still be able to increase because the area of land that has not been used is still quite extensive. If the government consistently applies Minister of agriculture regulations (*Permentan*) Number 60 of 2012 concerning the Import Recommendation of Horticultural Products and Minister of trade regulations (*Permendag*) Number 60 of 2012 concerning Provisions on the Import of Horticultural Products that were officially issued in January 2013, it is not impossible that self-sufficiency in horticultural products will be achieved. Because, with the strict import ban, inevitably domestic production must be boosted. So that in the upcoming export-import balance report Indonesia will no longer experience a deficit balance sheet. Red chili production centers in Indonesia are found in several provinces in Java and Outside Java. The total contribution in these provinces was 79.33% of Indonesia's total red chili production (Figure 1.2). Based on the average production in 2011-2015, West Java gave contribution 22.95% to the total production of Indonesian red chili, which amounted to 240864 tons from total production of 1045182 tons. Furthermore, it was followed by North Sumatra 17.94%, Central Java 14.68%, East Java 9.59%, West Sumatra 5.83%, Aceh 4.56% and Bengkulu 3.77% (Ministry of Agriculture, 2016).

According to the Horticultural ATAP data, 2015, about the distribution of chili production in the regencies / cities of West Java. Garut is the main production center of red chili in West Java with a production in 2015 of 75.72 thousand tons or 33.16% of the total production of red chili in West Java, followed by Cianjur (25.84%) and Bandung (10.93%) . Chili production in other districts / cities only contributed less than 10%. While the position of TAsikmalaya Regency was ranked fourth of chilli producer with a contribution value of 7.89 percent.

Tasikmlaya Regency is one of the fourth producers of red chili, with a total production of 168249 Kw out of a total production of 2421130 Kw or around 7.89 percent. The production was produced from a harvested area of 17621 Ha. When viewed from the percentage level of contribution from Tasikmalaya Regency at the provincial level is still relatively low. This condition can still be improved by increasing productivity, so it is necessary to study the level of efficiency of the red chili farming. Measurement of efficiency is one measure of performance in farming. This condition is also inseparable from the classic problems of farmers, namely narrow land tenure, low productivity of farming. This condition is also inseparable from the classic problem of farmers, namely narrow land tenure, low farming productivity. This is also reinforced by Ellis (2003) argues that most small farmers in developing countries behave risk aversion. Farmers' behavior to avoid risk results in inefficient allocation of input use, which in turn affects the level of farm productivity.

In the upstream sector, farmers also face marketing problems. According to Farid and Subekti (2012) states that chili price fluctuations occur because chili production is seasonal, rain factor, production costs, and the length of distribution channels. The problem of red chili related to price fluctuations has always been a concern for farmers. The very intensive increase in chili production at certain times often causes a drop in chili prices on the market. This is because demand tends to remain in the short term while production is abundant. Seeing this fact, the role of marketing becomes very important for the sustainability of the red chilli farming so that a reasonable price can be accepted by producers.

Based on the problem of low productivity, high diversity of productivity, sharp price fluctuations, and the behavior of farmers in facing risks, the general objective of this study is to assess the efficiency of curly red chilli farming. Specifically, this study aims to: (1) Know the factors affecting the production of red chili, (2) Know the technical, allocative and economic efficiency, analyze the factors affecting the production of curly red chili, and (3) Know the main factors affecting inefficiencies in farming curly red chili and identify the factors causing technical inefficiencies.

MATERIALS AND METHODS

The study was conducted using descriptive methods. Descriptive method is a method in examining the status of a group of people, an object, a system of conditions, a system of thought, or a class of events in the present (Nazir, 2005).

Determination of the location of the study was determined by *purposive sampling,* namely Cigalontang Sub-District, with consideration as a center of curly red chillies in Tasikmalaya Regency with an area of 1,488.40 Ha with a total production of 5,489 tons / year.

Determination of research samples using *multistage random sampling techniques,* namely the use of various random sampling methods together as efficiently and effectively as possible. The research location was determined in Cigalontang sub-district, then the Parentas Village was determined. This is because the village is a production center for curly red chili. Determination of the number / size of samples using a *random sampling* method. The population of curly red chilli farmers is 468 people and taken 10 percent. So the sample numbered 47 people.

Data collection is carried out in accordance with the needs of the data used to answer the research objectives. For data collection using three kinds of techniques, namely interviews, recording, and observation. Data which is collected in this study include primary data and secondary data.

The method of data analysis to estimate the efficiency of production is stochastic frontier production function analysis. Estimated production efficiency is the efficiency of the technical and economical efficiency. Technical efficiency is estimated using a stochastic frontier production function translog models with empirical equation as follows:

$$lnY = \beta_0 + \sum_{j=1}^{6} \beta_j lnX_j + \frac{1}{2}\sum_{j=1}^{6}\sum_{k=1}^{6} \beta_{jk} lnX_j lnX_j + (v - u)$$

Description:

Y = production (kg)
X_1 : Land area of curly red chili farming (ha)
X_{22} : Quantity of curly red chili seeds (gr)
X_3 : Quantity of manure (kg)
X_4 : Quantity of phosphate fertilizer (kg)
X_5 : Quantity of NPK fertilizer (kg)

X_6 : Quantity of TSP fertilizer (kg)
X_7 : Quantity of solid insecticide (kg)
X_{88} : Quantity of fungicide (liters)
X_9 : Labor (HKO)
v : random variables related to external factors
u : random variables related to internal factors or effect of inefficiency

The function of technical inefficiency is:

$$u_i = \delta_0 + \sum_{m=1}^{5} \delta_m Z_m + \mu$$

Z_m : variables that explain the effects of inefficiencies with the variable name: where variables affecting technical inefficiency are:
Z_1 : Age of household head of farmer household (years)
Z_2 : Formal education of household heads of household farmers (years)
Z_3 : The experience of household head of farmer household in curly red chili farming
u = random variables related to internal factors or effect of inefficiency
μ = random mistake of technical inefficiency

The level of technical efficiency of farming is calculated from the ratio of output observation
to output limits, using the formula:

TE of_i =Yi/Yi*= $\frac{\exp(xi\beta+vi-\mu i)}{exp(xi\beta+vi)}$ **= exp (-ui)**
TE of_i = E [exp ($-u_i$) | e_i] i = 1,2,3….n

Description :
TE of = technical efficiency of organic farmers-si
Yi = the amount of production of the i-th (Y potential)
Yi * = the amount of production expected in the observation of the i-th E [exp (-ui) | ei]
= the expected value (mean) of u, the condition oi, so 0 ≤ Tei ≤ 1, (Coelli, 1996).

RESULTS AND DISCUSSION

1. Efficiency of Chilli Farm

Efficiency analysis includes three types of efficiency, namely technical efficiency, allocative efficiency, and economic efficiency. The discussion of efficiency is based on the estimation results from the *stochastic frontier* model with the *Maximum Likelihood* (MLE) estimation method. In addition to estimating efficiency, the *stochastic frontier* model can also estimate factors that affect inefficiency.

A. Technical Efficiency

Estimation of Production Function

The discussion of technical efficiency becomes important in the discussion of the production efficiency of a business because technical efficiency is a component of economic efficiency. Economic efficiency cannot be met if technical efficiency is not achieved. In order to estimate technical efficiency, the *Cobb Douglas stochastic frontier* production function is used. Estimation results are presented in table 1

Table 1. Results of Production Function estimation of red Chilli Farm with *stochastic frontier*

Variable	Coefficient	t-ratio
A constant	6.22 ***	6.09
Land area (X_1)	0.19 *	1.89
Seed (X_2)	-0.07 ^{ns}	-0.97
Manure (X_3)	0.06 ^{ns}	.94
Phonska (X_4)	0.16 **	2.51
NPK (X_5)	0.19 *	1.75
TSP (X_6)	0.05 ^{ns}	0.85
Solid insecticide (X_7)	0.10 ^{ns}	1.49
Fungicide (X_8)	0.09 ^{ns}	1.46
Labor (X_9)	-0,16 ^{ns}	-1.14
Sigma squared	.10 ***	4.51
Gamma	0.99 ***	46.33

Dependent variable: production
Note: ***) t value α 1% = 2,711, **) t value α 5% = 2,025, *) t value α 10% = 1.68
Source: processed Primary data (2018)

Based on Table 1 it is explained that the estimated value of the *Cobb Douglas stochastic frontier* production function already illustrates the best model performance. This can be seen from its the *sigma squared* and *gamma* parameters. The *sigma squared* parameter shows the total variance of the two components, namely the inefficiency effect (vi) and the noise effect (ui). The calculation results obtained *sigma squared* values greater than zero, 0.10 significant at t-α 1%. Furthermore the *gamma* value of 0.899 and significant at t-α 1% which means that 89.9% of the variation of chili production is caused by differences in technical efficiency and the rest (10.1%) is caused by external factors (noise), such as weather and plant disease and pest attack. Based on table 1, it is also explained that the factors of production which are made as a predictor for chili production, there are three factors of production that significantly influence the production of chillies, namely land area, phonska fertilizer, and NPK fertilizer. Whereas the variables that had no effect were seeds, manure, TSP fertilizer, solid fungicides, insecticides, labor. Each of these variables is explained as follows:

B. Effect of seeds.

Seed has no significant effect and has a negative coefficient. This shows the potential for a decrease in production if there are additional seeds that are possible because if more seeds are used, the closer planting distance will result in competition between plants to obtain nutrients. With dense plant distance, the leaves between plants are getting denser so that growth is not maximum.

C. Effect of manure.

Manure does not have a significant effect but it has a positive regression coefficient. Organic fertilizer is a provider of micro nutrients so the impact of its use is not quickly visible and it takes time to feel the benefits of organic fertilizer. Besides that manure can also function as a water binder. Therefore the use of manure in the dry season and rainy season must be distinguished. In the rainy season it is recommended to reduce manure on vegetable farming to avoid excess water in the soil and avoid rotten of root.

D. Effect of pesticides.

Pesticides, in this case insecticides and fungicides, have no significant effect on chili production. The results of the qualitative study support this finding, that the main objective of farmers spraying pesticides is primarily aimed at preventing the chilli crop from being attacked by plant-disturbing organism (*OPT*). Even if the chili plants are not attacked by pests, farmers will continue to spray pesticides regularly. It is different if the farmers only spray when the plants have been attacked by pests, so it does not increase production but keeps production not to be decrease

E. Labor influence.

Labor does not significantly influence the production of red chili farming. Basically, labor does not directly influence plant growth, but the work done by labor can support the development or growth of plants related to curly red chili production. Labor is needed from preparing land for making, selecting and cleaning seeds, planting, fertilizing, spraying, watering, weeding and harvesting.

2. Technical Efficiency Distribution

According to Bakhsh and Ahmad (2006), if the efficiency value is greater than 0.7 it can be categorized quite efficiently and according to Kurniawan *et al* (2008) if the efficiency index value is greater than 0.8 it can be categorized efficiently. Based on these two opinions and the results of the average efficiency index (0.44) achieved by farmers (Table 2), it can be concluded that in general the chilli farming has not yet reached the efficient category.

Table 2. Distribution of Technical Efficiency of Chilli Farming

Technical Efficiency (TE)	Number of Respondents	Percentage
0.00 - 0.10	0	0.00
0.11 - 0.20	1	2.08
0.21 - 0.30	8	16.67
0.31 - 0.40	10	20.83
0.41 - 0.50	17	35.42
0.51 - 0.60	7	14.58
0.61 - 0.70	0	0.00
0.71 - 0.80	3	6.25
0.81 - 0.90	1	2.08
0.91 - 1.00	1	2.08
Average efficiency	0.44	
Minimum efficiency	0.12	
Maximum efficiency	.99	

Source: processed Primary data (2018)

Table 2 shows that the majority of farmers (95.83%) have not yet achieved technical efficiency. This can be an indicator that the application of cultivation technology and innovation at the farmer level has not been good (Ramli, 2012), for example the use of production factors that are not appropriate both in number and time and cultivation techniques that are not appropriate.

3. Factors Affecting Inefficiency

Model errors or so-called inefficiencies in frontier functions can come from two sources. First, external errors that cannot be controlled and errors that originate from internal farmers or reflect the managerial level of farmers (Ogundari and Ojo, 2006). The technical inefficiencies analyzed in this study are the inefficiencies caused by internal farmers associated with socio-economic factors, namely age, education, experience. The results of the inefficiency function estimation (inefficiency effect model) are presented in Table 3.

Table 3. Estimation of Factors Affecting Technical Inefficiency of Red Chilli Farming

Variable	Coefficient	t-ratio
A constant	1.51 ***	3.49
Age (X_1)	0,001 ns	0.20
Education (X_2)	-0.04 ns	-1.10
Experience (X_3)	-0.07 ***	-2.29

Source: processed Primary data (2018)
Note: ***) t value α 1% = 2,711, **) t value α 5% = 2,025, *) t value α 10% = 1.68

Table 3 shows that there is only one variable that affects inefficiency, which is the experience of farmers. Farmer experience has a significant effect on inefficiency, a negative sign indicates that the longer the experience the more the level of inefficiency decreases or increases technical efficiency. Farmers who have longer experience in farming are better prepared and have better knowledge in their farming. They are more efficient in using labor, seeds, and fertilizers that are more responsive to output (Revina-Molina, *et al,* 2015)

Although not significant, there is a tendency for higher levels of education to reduce inefficiencies or increase technical efficiency. Formal education will increase the ability of farmers to understand modern agricultural activities with the aim of increasing efficiency in their farming (Represents and Isa, 2015).

A. Allocative Efficiency (AE) and Economic Efficiency (EE)

Allocative efficiency is the ability of chilli farmers to use the minimum level of input in conditions of prices of production factors and fixed technology. Allocatively, it is said efficient, if at a certain level of input and output prices the proportion of the use of inputs has been optimum. Alloctive efficiency values are obtained by dividing economic efficiency values by technical efficiency. Economic efficiency itself is estimated by using the frontier stochastic cost function using the MLE method.

B. Factors Affecting the Cost of Chilli Farming

Chili farming is one of the capital-intensive Horticultural Crops where capital is not insignificant compared to farming of food crops or secondary crops. The results of the cost function estimation are presented in Table 4.

Table 4. Result Estimation of the *Stochastic Frontier* Cost Function of Red Chili Farming

Variable	Coefficient	t-ratio
A constant	-0.50 ***	-48.4
Land area (Y)	0.95 ^{ns}	0.61
Seed Price (C_1)	4.20 ***	6.84
Price of Manure (C_2)	0.58 ***	8.92
Price of Phonska (C_3)	-0.07 ^{ns}	-1.23
NPK Price (C_4)	0.66 ^{ns}	1.42
Price of TSP (C_5)	0.02 ^{ns}	0.03
Price of solid insecticide (C_{66})	.21 ***	2.34
Fungicide Price (C_7)	-0.02 ^{ns}	-0.18
Labor Wages (C_8)	0.26 **	2.11
Sigma squared	0.093	2.57
Gamma	.99	46.64

Source: processed Primary data (2018)
Note: ***) t value α 1% = 2,711, **) t value α 5% = 2,025, *) t value α 10% = 1.68

Table 4 shows that there are four factors of production costs that affect the total cost of chilli farming, namely seeds, manure, insecticides, and labor.

4. Distribution of allocative efficiency and economic efficiency

Allocative efficiency is the division between economic efficiency and technical efficiency while EE is the inverse of cost efficiency .The distribution of EA and EE of chilli farming is shown in the following Table 4:

Table 4. Distribution of Allocative Efficiency and economic efficiency of red Chili Farming

Efficiency Index	EA		EE	
	N	%	N	%
0.00 - 0.10	0	0.00	0	0.00
0.11 - 0.20	2	4.17	38	79.17
0.21 - 0.30	10	20.83	6	12.50
0.31 - 0.40	16	33.33	2	4.17
0.41 - 0.50	10	20.83	0	4.17
0.51 - 0.60	3	6.25	0	0.00
0.61 - 0.70	4	8.33	0	0.00
0.71 - 0.80	1	20.8	0	0.00
0.81 - 0.90	0	0.00	0	0.00
0.91 - 1.00	2	4.17	0	0.00
Average	0.425		.178	
Minimum	.162		.109	
Maximum	0.941		.459	

Source: Primary data processed (2018)

By referring to the 0.8 efficient limit, it can be concluded that the chilli farming has not been efficient either allocatively (on average 0.424) or economically (average 0.178). When compared with the average technical efficiency, the two efficiencies are lower. These conditions can be a picture of the condition of agriculture in developing countries, including Indonesia. According to Nuhraeni (2012), in general agricultural development policies in developing countries still focus on technical issues related to efforts to increase productivity, such as the use of seeds of superior varieties and agricultural mechanization. Whereas policies to improve economic efficiency such as price policies are still weak both in policy making and supervision, for example the subsidized fertilizer policy which has been determined the Highest Retail Price (*HET*) cannot be enjoyed by farmers optimally because farmers pay subsidized fertilizer above its *HET*.

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded as follows : (1) Factors affecting the production of curly red chilli farming are land area, phoska fertilizer and NPK fertilizer, while seeds, manure, TSP, solid insecticides, fungicides and labor are not significant effect, (2). Curly red chilli farming activities are generally not efficient either technically (an average of 0.44), allocatively (an average of 0.424) or economically (an average of 0.178), and (3). Factors influencing inefficiency are farmer's experience, while age and education have no effect. This is due to the skills and knowledge of curly red chili farming obtained from generation to generation.

RECOMMENDATION

Based on the research results obtained, it is recommended as follows: First, with the condition of this red chilli farming that is not yet technically efficient, it is necessary to optimize the use of production inputs. Considering the cost used for this red chilli farm requires high production inputs so that the costs are also high, it is hoped that there will be a government assistance program in providing production facilities through the addition of fertilizer subsidies, especially organic fertilizer. Second, there is a need for coaching and developing the skills of chilli farmers through improving agricultural extension programs. This is because the science and knowledge of farming of red chilli farmers in the study area are hereditary and have not been based on the technical guidelines of chilli farming. Third, infrastructure needs to be improved to facilitate farmers' access both to markets and skills enhancement in farming.

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