Analysis of Efficiency of Chili Production Cost

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Abstract. This research aimed to find if the chili production has been efficient. The efficiency was perceived from the cost aspect. This research was important to avoid any inefficiency of input use in chili production. The more efficient the costs, the bigger the profit received by the farmers. One of factors leading to the lack of farmers' interest in growing chilies was the small profit as well as the high price fluctuations. The inefficiency of the input use caused high production costs. Therefore, it was important to find if the chili production has been efficient. The data were obtained from 30 chili farmers of three villages of Rasau Jaya sub-district, Kubu Raya district. The samples were determined using balanced simple random sampling method. The cost analysis was done by estimating the frontier cost function. The efficiency levels were calculated by comparing the real costs and the frontier costs. The results revealed that the input use was efficient. The average cost efficiency was 1.4. The implication of this research was that further study is required to find the sustainablility of the efficiency.

Keywords: Inefficient · Frontier · Profit · Production · Maximum likelihood estimation

1 Introduction

Ten commodities which reached the highest price in Pontianak in August 2019 were chilis, hospital tariffs, long jawed mackerels, prescription drugs, workman salaries, yardlong beans, university tuition fees, oranges, golden jewelry, and green beans respectively [1]. This showed that the demand for chilies was high. This provided opportunities for chili production business. Theoretically, chili farming will offer benefits to farmers. In Tapengpah, Insana sub-district, Timor Tengah Utara district, the value of Revenue Cost Ratio (RCR) of chili farming was 7.12 [2]. Chili farming in West Kalimantan was highly potential to be developed by implementing several appropriate strategies[3]. In addition to the benefits, efficiency was important variable to be analyzed. Nevertheless, the estimation result of the frontier cost function of chili production in Rejang Lebong district revealed that farmers worked at technical efficiency level less than 50% [4].

Similar to other farmings, chili farming has different production opportunities. Technically, each farming implements various possible input-output combinations. The differences were resulted by the available inputs owned[5]. The efficient input use results in optimal output. The analysis used to calculate the efficiency has been widely done. Most of them were production frontier analysis approach [6]. Another possible

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approach to calculate the efficient input use was the frontier cost approach[7][8]. The frontier cost function explained the minimum cost which is potential to spend for some certain resulted outputs.

Assumed, the cost function analyzed was :

$$Y_i = x_i\beta + (V_i + U_i)$$

Y_i is cost; x_i is production; β is parameter; V_i is random variable assumed as $iid\ N(0, \sigma_v^2)$ and U_i is non-negative random variable assumed as inefficient cost value, $iid\ |N(0, \sigma_u^2)|$.

The calculation of technical efficiency by dividing frontier cost and prediction value of cost function was [7] [8]:

$$EFF_i = E\left((Y_i^*)\middle|U_i, X_i\right)/E\left((Y_i^*)\middle|U_i = 0, X_i\right)$$

The analysis of chili farming has been widely done in West Kalimantan. Nonetheless, analysis of farming efficiency using cost production approach has never been done. Therefore, a study on efficiency of production cost of chili farming in West Kalimantan is important to do.

2 Method

2.1 Place and Time

This research was done in Rasau Jaya II, Rasau Jaya sub-district, Kubu Raya district. The consideration was that it was one of areas of program development of crop plants, particularly chilies. The research was done for 3 months, from March to May 2019.

2.2 Data Collection

The collected data involved primary and secondary data. The primary data were obtained from various published reports. The secondary data were obtained through survey method, including direct observation, and interview in Rasau Jaya II, Rasau Jaya sub-district, Kubu Raya district. The number of chili farmer population was 75 people. The sample was 50% of the population..

2.3 Data Analysis

There were three stages to estimate the frontier cost function of chilies. The stages were [6][9]:
The first stage was estimation of production cost function, using ordinary least squares (OLS), as:

$$C_i = \beta_0 + \beta_1 Q_i + \beta_2 Q_i^2 + \beta_3 Q_i^3 + \varepsilon_i$$

C_i is cost, Q_i is production, β_i is parameter, and ε_i is error term.

The second stage was determining the γ value, with parameter β (excluding value of β_0) obtained from OLS with the value of parameter β_0 and σ^2 adjusted with OLS and corrected using formula proposed by Coolli [7]. Parameters μ, η or δ were set into zero. The third stage was using the value obtained from the second stage as the initial value for interaction process to obtain the final estimation value, maximum likelihood, with Davidon-Fletcher-Powell Quasi-Newton method. The data analysis applied Frontier version 4.1.

3 Result and Discussion

3.1 Result

Table 1 shows the estimation results of chili production cost function using OLS.

Table 1. The Estimation Results of Chili Production Cost Function.

Variable Name	Estimated Coefficient	Standard Error	T-Ratio
Constant	0.10079690E+08	0.23224358E+07	4.340
Q	-0.92273642E+04	0.43015732E+04	-2.145
Q^2	-0.70522533E-03	0.21648005E+01	2.869
Q^3	0.44952 x 10^{-3}	0.28686950E-03	-2.458

*$E\varepsilon$ = 0.00000000E+00
*eta is restricted to be zero

All variables of the cost function indicated significant effects on production costs. This shows that the model is applicable for the analysis.

Table 2 shows the final estimation results using MLE.

Table 2. The Final Estimation Results of Chili Production Cost Using MLE.

Variable Name	Estimated Coefficient	Standard Error	T-Ratio
Constant	0.91703623E+07	0.16585412E+01	0.55291737E+07
Q	-0.90705203E+04	0.63191573E+03	-0.14354003E+02
Q^2	0.60417442E+01	0.59998484E+00	0.10069828E+02
Q^3	-0.67568724E-03	0.99599589E-04	-0.67840364E+01
Sigma-squared	0.20294622E+13	0.10000000E+01	0.20294622E+13
Gamma	0.67187067E+00	0.13892557E+00	0.48361914E+01
Mu	-0.21635656E+00	0.13267198E+01	-0.16307630E+00

eta is restricted to be zero
log likelihood function = -0.45884093E+03

All variables of the final estimation of cost function using MLE also indicated significant effects on production costs.

Both estimations were used to calculate the efficiency of chili production cost. Table 3 shows the efficiency values of chili production cost per farmer and their average.

All the 30 farmers were efficient in managing their chili farming. This was indicated by the efficiency value, that was above 1. The farmer no 25 was the most efficient farmer, and the farmer no.26 was the least efficient of all. The average efficiency value was 1.14.

Table 3. Efficiency Values of Chili Production Cost per Farmer and Their Avergare.

farmer	eff.-est.	Farmer	eff.-est.	farmer	eff.-est.	farmer	eff.-est.
1	1.1349623	9	1.1406981	16	1.1025832	24	1.1150612
2	1.1394518	10	1.1285411	17	1.1417372	25	1.2334257
3	1.1142252	11	1.1362888	18	1.1425090	26	1.0222231
4	1.0332218	12	1.1376294	19	1.1805107	27	1.1492319
5	1.1362888	13	1.1101797	20	1.1348001	28	1.1420785
6	1.1339708	14	1.1349623	21	1.1080202	29	1.1413473
7	1.0263623	15	1.1417372	22	1.1517986	30	1.1310677
8	1.6537102			23	1.1431353		
	Mean				1.1447253		

3.2 Discussion

The result of data analysis showed that all of the chili farmings were efficient. It was viewed from the production cost. There were some factors resulting in the efficient chili farming, which are: 1) fields, 2) farmer ages, 3) farmer education levels, 4) seasons, 5) farmer groups, 6) field and parcel ownership status, and 7) farming location [10]. Furthermore, the efficiency of farming was determined by: 1) farming duration, 2) participation in agricultural extension, and 3) agriculture management system [6]. Another factor which resulted in the efficiency was technology use in a production process [8][11].

Field was the most responsive factor in improving the production [10]. The field used by the farmers in farming was approximately 0.34 ha. It offered intensive farming management, indicated by the number of manpower used. Most of the farmings were run by the family members. It was about 93.15%. Whereas, 16.85% of them was by non-family member. In addition to the width of field, the problem was the land fertility. In the research area, the filed was peat soils. Some of fruit and horticultural plants could grow well after the adaptation to the field condition and particular treatment for a certain time [12]. Considering the identification results of land physical characteristics, combined with the requirement of growing horticultural plants, the area was suitable for culturing the plants [13].

The use of technology was expected to improve the efficiency of agricultural production process. The more the technology use, the lowest the cost and the higher the resulted production [13][17]. The technology use was highly related to the adoption of technology. Both farmer groups and farmer participation in agricultural extension were factors that fostered the adoption. In the research area, all farmers have joine farmer groups and actively participated in the extension program. Generally, the government assistance programs were distributed through the groups; the role of the groups were important in implementing new technology [15].

4 Conclusion and Recommendation

4.1 Conclusion

In accordance with the discussion, it was concluded that: 1) the chili farming in Rasau Jaya II, Rasau Jaya sub-district, Kubu Raya district was efficient with 1.14 of the average efficiency value; 2) the factors expected to result in the efficient chili farming were: a) fields, b) farmer ages, c) farmer education levels, d) seasons, e) farmer groups, f) field and parcel ownership status, g) farming location, h) farming duration, i) participation in agricultural extension, j) agriculture management system, and k) manpower use; 3) the main factors considered to result in the efficient chili farming were field and manpower use.

4.2 Recommendation

The advanced research is expected to ensure the causes of efficient chili farming in Rasau Jaya II, Rasau Jaya sub-district, Kubu Raya district. To reach clear description of chili farming, comparing the farming in the area with that in other areas is important to do.

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