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Impact of Production Efficiency and Appropriate Technology to Smallholder Dairy Farm's Revenue

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Abstract

The research aims to know the influence of appropriate technology toward smallholder dairy farm business revenue and to the technical efficiency of production factors. This research was conducted in Subang district to the members of dairy cooperatives smallholder dairy farmers from the 1^{st} April to the 30^{th} June 2015. The survey was used to collect the data from 30 respondents, chosen by simple random sampling. The Cobb Douglass analysis was used to determine the appropriate technology as production factors influenced dairy farm revenue. The result showed that the application of appropriate technology feed, cow-shed, breeding and innovation, were significantly affected to the farm revenue ($R^2 = 0.823$). For production factors, the positive effect of the revenue is show by feed and cow-shed, but the breeding and innovation are not giving effect. The technical efficiency showed that feed had achieved efficiently, drawn from the analysis of return to scale of 1.941. This value shows that the small holder dairy farm is on an *increasing return to scale* condition which is suitable to develop.

Keywords: Dairy Farmer, appropriate technology, revenue and farm business.

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1. Introduction

More than 90% of dairy farms in Indonesia are smallholder with a small scale farm and managed by traditional systems. This traditional rearing system led to low milk production. Dairy development efforts are directed farmer in order to improve farm income. A program to improve traditional dairy farming to be more advanced and more profitable can be done through the application of technological innovation. Adoption of appropriate technology is a bridge in order to increase the productivity of a business. On farm environmental and technological innovation as a tool, farmer as a subject, livestock as an object, and land as an ecological cultivation based [1]. Thus, the application of various technological innovations through appropriate technology is necessary to improve and to develop dairy cattle business.

Dairy farm business in Ciater was dominated by farmers with an average milk production of 9.2 liters/head/day in 2010 [2]. Low farmer's technology adoption in breeding, feeding and management in Ciater contribute to low average milk production. Therefore, farmers need appropriate technology in dairy breeding, feeding and management especially the cow-shed management, to increase milk production.

The main objective of dairy farming is to get the maximum income from milk production with the smallest input. Many farmers generate low income because of inefficient use of production factors which will be detrimental to farmers. Efficiency is the number of physical production results which can be obtained from a single unit of production factors (input) [3]. Technical efficiency is the efficiency of the connections between actual production and maximum production. An efficient used of production factors is said to be technically (technical efficiency) when the factors of production used to yield maximum production [4].

Acording to the background, we are interested to know the conditions of acceptance of dairy farmers in. Ciater selected districts after the application of the appropriate technology. The purpose of this study is to know the influence of the appropriate technology toward smallholder dairy farm business revenue and to the technical efficiency of production factors.

2. Materials and Method

The research used survey method. Thirty small holder dairy farmer as respondent selected using simple random sampling. The Cobb Douglass analysis was used to determine the appropriate technology as well as which production factors that influence dairy farm revenue. Data for current business conditions of farmers were collected in 3 months, from the1st April to the 30th June 2015.

Cobb-Douglas production function is used to analyze the first and second hypothesis. The function models are the following equation:

$$Y = aX_1^{b1} X_2^{b2} \cdots X_i^{bi} e^u \quad (1)$$

To make the estimation much simpler, the equation is converted into a linear shape by changing the logarithmic equation, that can be written as follows:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + c_1 \ln D_1 + u \quad (2)$$

Note:
Y: Revenue (IDR)
X_1: feed (Kg)
X_2: cow-shed management
X_3: Breed (IDR)

D_1: Dummy Innovation Technology
a, b, c: Coefficient
u: residual (residual)

2.1. Test the hypothesis I

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + c_1 \ln D_1 + u \quad (3)$$

H_0: $b_1 \ldots c_1 = 0$
H_1: $b_1 \ldots c_1 \neq 0$

F tests conducted on all factors of production (X) together to see its effect on revenues (Y). T test conducted to establish the real absence of influence of each factor of production, which is incorporated into the model for milk production. The coefficient of determination (R_2) is a coefficient that states the influence of factors of production (X) to production (Y) in this case is revenues [5]. (Gujarati, 2015).

2.2. Test the hypothesis II

In the Cobb-Douglas production function; b = elasticity of production (Ep) further, the hypothesis are:

Ho: If Ep> 1 and Ep <0, the dairy farmers of the people are in a state of 'irrational technically' in the use of production factors.

H1: If the elasticity of production in the region 0 < Ep < 1, the dairy farmers are technically rational people in the use of production factors.

Analysis of business scale can also be seen from the sum of $b_1 + b_2 + b_3 + c_1$.

3. Results and Discussion

3.1. State geography

The Ciater sub-district is an area of tea plantations which consists of 7 villages. It's located at an altitude of 800 meters above sea level, with an area of 7,819.87 Hectares. It a temperatures between 22°C and 32°C with the amount of annual rainfall fluctuated on average of 2,275 mm/year. Accompanied by the wet climate throughout the year and relative humidity of 60% to 70%. The Ciater sub district is suitable for the development of dairy cattle business [6].

3.2. Identity of respondents

The characteristics of the respondents observed in this study include the age level formal education, farming experience, and farm scale. All respondents were included in the productive age catagory, they tend to be highly responsive to new innovations. However, most of the respondents earn low formal education level, since 59% of them finished up to elementary school. Their rearing experience is on average 5–10 years and 68.75% of respondents owned productive livestock on small scale, around 1-3 head per household. This causes the dairy farm business income to be lower. The all respondents have a background as a farmer tea plantations, before they became dairy farmers, and about 20 years ago dairy milk industry company introduce of a dairy cow in this region.

3.3. Milk production

Dairy milk production is affected by a combination of genetic and environmental factors [7]. One of the factors that greatly affect the production of animal is feed. The average milk production in the subdistrict is 11.34 liters/head/day, the number of forage/grass and concentrate provision is consequently 30-50 kg/head/day and 6 kg/head/day. This average production is better when compared to the average production of milk in 2010, which is about 9.2 liters/ cow/day [2].

To that amount, feeding was adequate because the quantity given is meeting the cow's nutrition requirement. The provision of concentrate in lactating cows is equal to 50% of the milk produced [8]. In the sub district, the average milk production is increased because of the application of technology by farmers. Technology implementation is related to feed, cowshed and breed. Feeding technology is including the provision of forage concentrates, feed additives and feed additives silage. Cow-shed technology related to the change in the layout of the stable and the stable facilities. While the breeding technology implemented, means selecting cows to get the high breed quality.

3.4. Factors that influence the dairy farm business revenue

Results of regression analysis on the factors that influence the revenues of dairy farming using Cobb-Douglas models are presented in Table 1. In Table 1 Shows that; R^2 is 0.823, which means that 82.3% of business revenues is explained by the application of feed, cow-shed, breed and technology, while 17.7% is explained by other variables besides the variables in our model.

To test the joint effect of inputs or factors of production to business revenues generated by breed, F test is conducted. The F-test showed that the variables used jointly have a significant effect on business revenues (F = 28.982). Based on this analysis can be explained that the revenues is affected jointly by all factors of production.To test whether or not a significat influence of each factor on the revenue is existed, we run the t-test. It showed that, partially that feed and cow-shed application have a significant effect on business revenues. Each addition and subtraction on feed and cow-shed applications will have significant impact on business revenues. It can be understood that the feed and cow-shed, are the external factors that can be a strong influence on milk production. If production increases would lead to an increase in revenues. Milk production is affected by the feed, water consumption, the age of cattle, cow-shed and milking interval [9].

Application of feed has a regression coefficient of 1.006, meaning that each one percent additional factors of production would result in increase of output by 10.06%. Applications of cow-shed has a regression coefficient of 0.694. The addition of one percent of the cow-shed technology applications will increase the revenue of 6.94%. Applications of breeds have gave a regression coefficient of 0.205. It means, addition of one percent of the quality of breed will increase revenue of 2.05%. Technology has a regression coefficient of 0.036. The addition of one percent of technology will increase revenues by 0.36%. This proves that with the application of technology, livestock production has increased so that farmers will generates more income. The results of this analysis illustrates that for feed and cow-shed effect is very high (10.06% and 6.94%), while the beeds are very low (2.055) as well as with the use of technology (0,36%). This is allegedly that the quality breed condition around Ciater is not good, while that the lack of technological innovation, due to dairy farmers in the region are relatively new.

3.5. Technical efficiency

Cobb-Douglas analytical results in this study are:

$$Y = 1.391 X_1^{1.006} X_2^{0.694} X_3^{0.205} D_1^{0.036} \quad (4)$$

The model function when the change becomes linear would be:

$$\text{Ln}\, Y = 1.391 + 1.006 \text{Ln}\, X_1 + 0.694 \text{Ln}\, X_2 + 0.205 \text{Ln}\, X_3 + 0.036 \text{Ln}\, D_1 \quad (5)$$

Technical efficiency is illustrated through the elasticity of production (Ep) of each factor of productions. If the value of technical efficiency is equal to one then the use of inputs or factors of production is efficient. On the other hand, if the value of the technical efficiency of less than one, then the use of inputs or factors of production

Table 1: Cobb-Douglas analytical results (Ln).

Variable	Regression Coefficient	T_{count}	R^2	F_{count}	T_{tab}	F_{tab}
Constant	1.391	0.160	0.82	28.98	2.05	2.98
Feed (Kg)	1.006	8.504				
Cowshed	0.694	2.357				
Breed (Rp)	0.205	0.390				
Technology	0.036	0.248				

is not efficient. In Cobb Douglas production function, regression coefficient is the Ep value of each factor of production. In Table 1, it can be seen that testing the technical efficiency of production factors contained in the variable feed applications. Elasticity $b_1 + b_2 + b_3 + C_1 = 1.941$. The value shows that the small holder dairy farm business is in an *increasing return to scale* condition, thus it is suitable to be developed. This condition indicates that the small holder dairy farm in this region, the most favorable business conditions.

4. Conclusion

The result showed that the application of appropriate technology of feed, cow-shed, breeding and innovation, were significantly affected to the farm revenue ($R^2 = 0.823$). As a production factors, feed and cowshed had positive effect, but the breeding and innovation did not affect the farm revenue.

The technical efficiency showed that feeding had achieved efficiently, according to the analysis of return to scale where the Elasticity (E) = 1.941. This value showed that the small holder dairy farm business is in an increasing return to scale condition which is suitable to be developed.

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