Indrayani_2019_IOP_Conf._Ser._
_Earth_Environ._Sci._287_01203
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Analysis of the determining factor in profit efficiency of quail farming in Payakumbuh Sub-District, Lima Puluh Kota Regency

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Abstract. Demand for egg consumption in Indonesian society being one of the great opportunities to establish quail farms business. The goal of this research is to measure number of profit and to identify the affecting factors of profit efficiency on quail farms in Lima Puluh Kota Regency. Cross section data obtained from quail farmers were used. Thirty samples from the farm with $\geq$ 4000 quails selected by accidental sampling were obtained. Income analysis and Stochastic Frontier Analysis (SFA) were used for statistical analysis. This study exhibited a considerable capacity to improve quail profitability. The determining factor in profit efficiency of quail farming business in Payakumbuh sub-district, Lima Puluh Kota regency were feed, quail breed and fixed costs and also the number of productive quails. The average level of technical efficiency achieved by quail farmers was 0.527. In other word, the average productivity achieved was 52.7%. The most important factor that affected the profits inefficiency was the farmers'age. In conclusion, profit efficiency could be improved by minimize feed, quail breed, and fix costs and increase the number of productive quails.
Keywords – Quail farming, efficiency, profit, and stochastic frontier function.

1. Introduction

The high demand for egg consumption in Indonesia was considered as one of the great opportunities for the establishment of quail farming business. In 2013 and 2016, West Sumatra became the fourth largest quail egg producer in Indonesia with the total egg production of 2,785 tons and 2,614 tons, respectively and also as the largest quail meat producer in Indonesia. Although quail farms business in Lima Puluh Kota Regency was relatively low, in West Sumatra, Lima Puluh Kota Regency was considered to have the highest quail population. For the past five years, traditional quail farm business activities still continued despite the dominance of the agribusiness development of broiler chicken farming which has been intensively carried out in every region, especially in Lima Puluh Kota Regency. Although quail farming business was not as big and intensive as other farming businesses, this business had become a potential alternative business. Quail farming could be either a permanent or side business that provided additional income for the community or the farmers who worked on it.

The success of a farm business was determined by its management, maintenance management and the resources (inputs) used. In the quail farming business done by the farmers in Payakumbuh Sub-district, Lima Puluh Kota Regency, all the input variables and marketing of farming products were carried out independently. The farmers did not only provide their own capital, but they also directly manage the quail farming, including marketing the productions.

Some of the problems faced by quail farmers in Payakumbuh sub-district were the lack of availability of corn and fine bran used for concentrate mixture for quail feed. The corns were bought from Pariaman at a price of IDR 5,000/ kg and fine bran from Solok at a price of IDR 2,500/ kg. Changes in the price of feed raw material would affect the quail farming business and its production costs which ultimately would also affect the amount of profits obtained by farmers. The profits obtained were also influenced by the production while the production itself was strongly influenced by the maintenance management. Profit efficiency was determined by some factors, namely technical factors, production costs and farmers' demographic factors. Information about profit determining factors could be useful in changing the current quail farming system towards a more profitable and competitive one. This study aimed to analyze the factors that influenced profits efficiency in quail farming business in Payakumbuh sub-district, Lima Puluh Kota Regency.

2. Research method

This research was carried out in Payakumbuh Sub-district, Lima Puluh Kota Regency. The area was chosen based on the consideration that Payakumbuh Sub-district had the highest population of quail in the Lima Puluh Kota Regency. The number of samples used was 30 samples which were chosen using accidental sampling technique. The research variables were the benefits and factors that influenced the profit efficiency of quail farming business. The data were analyzed using the method of income analysis and processed using econometric model and explained descriptively. Profit efficiency was measured using *Stochastic Frontier Analysis*. Stochastic Frontier Analysis (SFA) [2] is an econometric approach that is generally used. SFA approach simultaneously estimate the frontier production function (or profit function) and inefficiency model, where the inefficiency effect is specified as a function from other variables that affect efficiency [3]. Empirically, this approach is expanded in the form of cost, profit and production functions. The model of *Cobb-Douglas* profit function can be written as follows:

$$\pi i = f(pi, Z) \exp(vi-ui) \text{ where } i = 1,2,3, n$$

The Cobb-Douglas function can be estimated as follows:

$$ln\pi = ln\ \beta 0 + \beta 1 lnpi + \beta 2 lnp2i + \beta 3 lnp3i + \beta n lnpni + \beta 4 lnZ1i + \beta 2 lnZ2i + \beta 3 lnZ3 + \beta n lnZn + vi - ui$$

where π is profit, p1, p2, p3, till p_n are the variable input price, whereas Z1, Z2, Z3 till Z_n are fixed input prices and other factors other than input prices that affect the profits obtained.

In this study the *Stochastic Frontier* model of quail farming business used is as follows:

$$ln\pi = ln\ \beta 0 + \beta 1 lnpi + \beta 2 lnp2i + \beta 3 lnp3i + \beta 4 lnp4i + \beta 5 lnp5i + \beta 6 lnp6i + \beta 7 lnZ1i + \beta 8 lnZ2i + \beta 9 lnZi3 + \beta 10 lnZ4i + vi - ui$$

Where:

Π = Profit from quail farming business (IDR/month)

P1 = Feed price (IDR/kg)

P2 = Cost of veterinary medicine (IDR/unit)

P3 = Quail breed costs (IDR)

P4 = Fixed Cost (IDR/month)

P5 = Labour Cost (hours/month)

P6 = Business scale (quail)

P7 = Number of productive quail (quail)

$\beta 0$ = intercept

βi = coefficient of parameter estimation

$vi - ui$ = error term (ui = technical inefficiency effects in the model and vi = the effect of external factors that are not modeled)

To measure the technical inefficiency effects in this study, the formula developed by Battese and Coelli (1995) in Coelli (1996) was used. The formula is as follows:

$$\mu i = \delta 0 + \delta 1 Z1 + \delta 2 Z2 + \delta 3 Z3 + \delta 4 Z4 + \delta 5 Z5 + wit$$

where:
μi = technical inefficiency effect
$Z1$ = the farmers' age (old)
$Z2$ = the farmers' formal education (years)
$Z3$ = experience in quail farming (years)
$Z4$ = *Dummy* Business Status ($Z41 = 1$, if it is main business and $Z42 = 0$, if it is side business)

The hypothesis testing used for measuring the parameter of frontier production function and technical inefficiencies was the *one-sided generalized likelihood ratio test* (*LR-test*).

3. Results and discussion

The development of quail farming business in Payakumbuh sub-district was influenced by many factors. For instances, the age of the people will affect them in terms of skills and experience, as well as their capacity to absorb new technologies and other things [7]. The result of this study showed that the age of the quail farmers ranges from 27 - 60 years old, which meant that they were still in their productive age.

The education level they received was also very important and would influence every decision they made or in adopting every decision making that deemed useful for their business development. The results of this study showed that the percentage of respondents who graduated from elementary school, junior high school, senior high school and university were 3.3%, 3.3%, 70% and 23.4%, respectively. It showed that the education level of the quail farmers was relatively high. Having good knowledge, should have helped people with higher education level to develop their business, both in terms of technical and business management.

One's experience in running a business would greatly influence their decision making to achieve maximum results. The length of quail farmers' experience in running the quail farming business in Payakumbuh sub-district varied between 3-14 years. It showed that the quail farmers in Payakumbuh sub-district had the experienced in quail farming business.

The business scale of quail farming business in Payakumbuh sub-district ranged from 4000-15000 quails, in which mostly were in the range of 5000-6000 quails. Seventy percent (70%) of the respondents (out 30 respondents) had decided to make quail farming business as their main business. This was because before starting quail farming business, they actually did not have permanent job.

The average profit obtained by quail farmers in one month was IDR 10,673,782 with the average number of quails raised per month was 6850 quails.

The estimation results of *Stochastic Frontier* production function were presented in Table 22. The sigma squared ($\sigma2$) and gamma (γ) values were 3.984 and 0.999, respectively, and real at the level of 99 percent. The gamma indicated the existence of technical efficiency in the production process, or variations in results caused by technical efficiency differences.

Table 1. Stochastic profit frontier estimates.

Variables	Parameters	Coefficients	t-ratio
Constant	β_0	26,914	26,781
Feed Price	β_1	-0,414**	-1.712
Cost of Veterinary Medicine	β_2	0,003	0,012
Breed Costs	β_3	-0,482***	-6,672
Fixed Cost	β_4	-2,199***	-6,254
Labour Cost	β_5	0,319	1,213
Business Scale	β_6	0.676	0,802
Number of productive quail	β_7	1,363***	3,634
Log-likelihood OLS			
Log-likelihood MLE	-33,133		
LR	22,556		

Notes: Statistical significance levels: ***1% ; **5%; *10%

The value of generalized likelihood ratio (LR) from the *Stochastic Frontier* production function was 22.556. It was greater than the critical value in *Kodde and Palm* Table (1986), i.e., 11.91 which was significant at $\alpha = 5\%$. It meant that there was a technical inefficiency effect in the model of certain technology.

The feed, breed and fixed costs had a significant negative effect on the profitability of quail farming business, while the number of productive quail had significant positive effect on the profits. On the other hand, the cost of veterinary medicine, labor and business scale did not significantly affect the profits. The cost of feed has a significant negative effect on the profit because there were differences between the type and the amount of feed provided by the farmers. For instance, there were farmers who provided complete feed or bought processed feed. There were also some farmers who mixed quail feed by themselves based on the predetermined formula, and other farmers who used the combination of complete and self-mixed feed. This matter had caused a difference in terms of feed expenses, in which complete feed was more expensive than self-mixed feed. Farmers who chosen complete feed reasoned that complete feed could help increasing the productivity of quail eggs. The quail breed cost had a significant effect on the profits because the quail farmers were likely obtained the quail breed in a different way. For instance, some of them would produce their own quail breed, buy the quail eggs and hatching it themselves, buy DOQ (day old quail) and others farmer would buy quail grower (30 days old quail). The different ways of getting the quail breed had caused the cost of quail breed to be varied. The method used to obtain the quail breed would also affect the quail productivity, because by choosing the quail breed on their own, the farmers could choose the breed quality and control its growth. The number of productive quails had a positive effect at the level of 0.01. It meant that the number of productive quail was directly proportional to the profit gained. The study conducted by [4] shows that feed prices have a significant negative effect on profits in all herd size categories. [1] found the major factors affecting the technical efficiency were feed, stock size, experience and farmer's educational level.

The average value of technical efficiency achieved by the quail farmers was 0.527. It meant that the average productivity achieved was 52.7. Therefore, in the short run, it is possible to increase production by an average of 47,3% by adopting efficient farming techniques. In other words, this mean value indicates that opportunity still exists for increasing productivity and income through increased efficiency in resource utilization. [1] found the mean of technical efficiency among the quail farmers in Ilorin, quara state, Nigeria is 60,5%. according to [5] proper management such as vaccination, cleanliness and sanitization ensures efficient production and good quality products (meat or eggs).

From this result, it could be concluded that the farmers were still lacking in the technical efficiency, thus the profits obtained were not yet maximum.

Table 3. Determinants of profit inefficiency among quail farms.

Variables	Coefficients	t – ratio
Constant	- 1,038	-1,006
Age (Z_1)	0,0466***	6,815
Formal education (Z_2)	0,259	-0,305
Years of experience (Z_3)	-0,675	- 0,725
Dummy Business Status (Z_4)	-0,0313	- 0,423

Notes: Statistical significance levels: ***1% ; **5%; *10%

From the frontier analysis results, it could be seen that the factors significantly affected the technical efficiency of quail farming business was the farmers' age. while the education level, experience and business status factors had no significant effect. The age factor had a significant positive effect on the technical efficiency of the quail farming business. [4] found age may also influence farm performance positively as older farmers are more experienced, and notably, can apply

accumulated knowledge to the efficient use of inputs. Farmers' education level is expected to positively influence farm performance. [6] found a positive relationship between education and technical efficiency.

4. Conclusion

The determining factor in profit efficiency of quail farming business in Payakumbuh sub-district, Lima Puluh Kota regency were the feed, quail breed and fixed costs and also the number of productive quails. The average level of technical efficiency achieved by quail farmers was 0.527. In other word, the average productivity achieved was 52.7%. The factors that affected the profits inefficiency was the farmers' age.

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Acknowledgement