Cost Efficiency and Management Performance on Sericulture in Roi-Et and Mahasarakham Province

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ABSTRACT

This research aims to measure cost efficiency and identify the factors affecting cost efficiency on sericulture in Roi-Et and Mahasarakham as well as comparing the farmer's management performance between high-efficiency and low-efficiency groups. The findings of this research can provide guidelines to increase the cost efficiency. Data are randomly collected from the farmers who operate sericulture in Roi-Et and Mahasarakham in the year 2007 with a sample size of 210. Data analyses are comprised of Stochastic Frontier Analysis (Cost Frontier), Tobit Regression, and mean comparison with t-statistic. The result suggests that cost efficiency (CE) equals 98.88% and the major causes of cost efficiency are management performance and credit availability from Bank for Agriculture and Agricultural Cooperatives (BAAC). The management performance on the high-efficiency group is greater than the low-efficiency group in planning, organizing, leading, and controlling. Therefore, to improve cost efficiency, the low-efficiency group could learn how to manage their production and management performance from the high-efficiency group.

JEL Classification: D24.

Keywords: Stochastic Frontier Analysis, Cost Frontier, Cost Efficiency, Management Performance, Sericulture

1. INTRODUCTION

Presently, the significance of international trade has been increasingly high and unavoidable. The attempt for having international trade especially free trade area (FTA) is widespread and it also directly affects the Thai farmers; so having FTA is the way to reduce the tariff barriers and non-tariff barriers among the trading partners. By the theory, FTA constitutes trade creation, that is, trading volume increases, in addition, domestic consumption also increases because of the low price of commodities. Consumers will get the benefit from the FTA but the producers will be affected negatively because they have to decrease the price to compete with the

imported goods which are cheaper. The profit becomes lower, and then farmers have to adjust themselves to reduce production. If they cannot compete; such as they cannot reduce the cost, they have to stop producing, so the workers will be unemployed.

FTA is considered to be an important economic tool to expand trading opportunities, to create economic alliances, and at the same time, to enhance the competitiveness of domestic goods and services. Under the WTO Agreement on Agriculture in 1994, Thailand specified the protection of agriculture production for 23 items during 1995-2005. During that time, Thailand hastened to adjust the structure of agricultural production under the agreement of WTO by reducing the government subsidies, which was the cause of production and market distortion; in these items, the raw silk thread was also included. When Thailand had started negotiating for the FTA since 2002, the adjustment of agricultural production structure was not progressing as expected and it was not ready to accept the changes from free trade in the agriculture sector under the agreement of WTO and FTA. The raw silk thread is one of the items under the framework of FTA. The import duty on raw silk thread has to be decreased to zero and also the agriculture import quota has to be given up. In the specific time the negotiating countries, namely China, India and Vietnam, Thailand have to adjust to the competition of the cost, quality and the standard of production because all the mentioned countries are the biggest producers of the world and they have significant influence over the raw silk thread market.

Besides, Thai silk and silk products are the symbols of Thailand, and are also remarkable for their beauty; furthermore, they also represent the industrial craftsmanship by the Thai workers which provides an appropriated Thai economic structure. This is because Thai silk industry generates jobs for the villagers and increases the profit from the work done in the villages, as well. For many years in the past, Thai silk and silk products have been profitable for the country in the value of billion Baht per year.

Thailand is ranked sixth in the world for producing raw silk thread. China is the leader of the world. India and Vietnam are the second and the third, respectively. Thailand exports Thai silk and silk products to the value not less than 9 million Baht each year. The quantity of production is 1,500 tons per year, but the domestic consumption of the country is 3,000 tons per year, so we have to import in great quantities. Besides, the cost of production is rather high when we compare with China and India but also found that silk production must be carried on carefully with adjustments in the production structures, due to the fact that the share of Thailand in world production is less and the domestic production is not enough. Most of the production is imported and we also found that India is our competitor. India is the second producer and it is our competitor in America, Europe and South Korea market, especially for the silk clothes, raw silk thread, silk wool and other silk products.

Therefore, we found that the agriculturists must prepare with readiness to increase the competitive capacity of agriculturists by reducing the cost of the production, it helps the agriculturists to be more competitive in the world market in the future and increases more benefits.

Therefore, this research aims to measure cost efficiency and identify the factors affecting cost efficiency on sericulture in Roi-Et and Mahasarakham as well as

comparing farmer's management performance between high-efficiency and low-efficiency group.

2. REVIEW LITERATURE

2.1 Theoretical framework of cost frontier

Cost Frontier shows the relation between the cost and output, including the price of input. The cost frontier can be shown in figure 1 and 2, respectively.
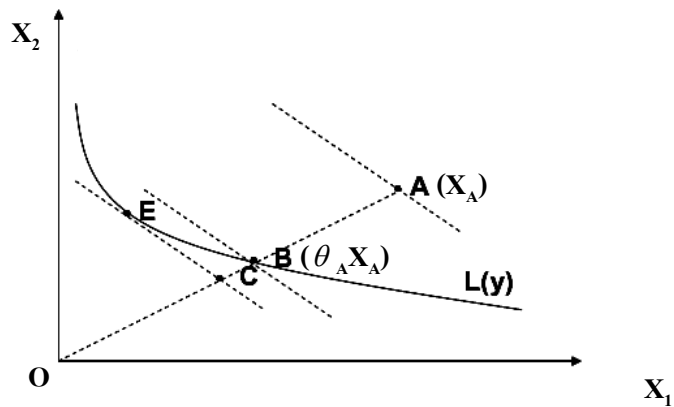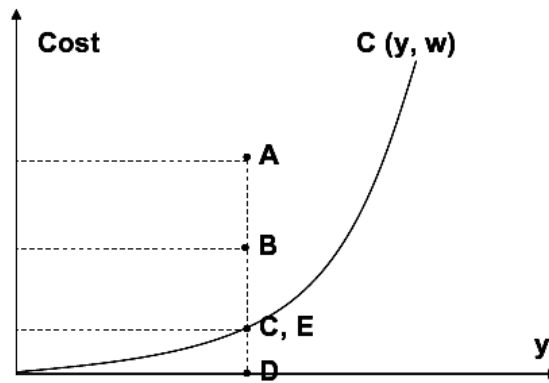

Figure 1.
Cost Frontier with Two Inputs

Figure 2.
Cost Frontier with an Output and Measuring Cost Efficiency

The calculation of measuring cost efficiency will assume that the producers confront with input price $w \in R_{++}^{N}$ and carry out $w^T x$ for the lowest cost to produce the output $y \in R_{+}^{M}$ so measuring cost efficiency is equal to the ratio of the lowest cost at the frontier per the existing cost and the allocative efficiency is equal to the ratio of the lowest cost at the frontier per the cost after the reduction of factors affecting cost efficiency. As shown in equation (1) and (2), respectively.

$$\text{Cost Efficiency; } CE(y,x,w) = c(y,w)/w^T x \text{ or } c(y,w)/E \tag{1}$$

$$\text{Allocative Efficiency; } AE_I(y,x,w) = c(y,w)/w^T(\theta x) \qquad (2)$$

Where θ is the minimum parameter reducing the input at the cost frontier which is shown by figure 2. Cost Efficiency; $CE = CD/AD$ and $AE_I = CD/BC$ or $AE_I = \text{Cost Efficiency}(CE)/TE_I$, when CE is equal to 1, it means the producer can produce at the lowest cost on the cost frontier curve, if the value of CE is less than 1, it means the producer can produce at the higher cost than the cost frontier curve. The model used in empirical studies is called stochastic frontier analysis (or cost frontier analysis in this case), which is shown in the equation (3). C_i is the cost of production. w_i is the input prices, y_i is the output, and β is the estimated coefficient $f(w_i, y_i; \beta)$ which is the production function.

$$\ln C_i = f(w_i, y_i; \beta) + u_i + v_i \qquad (3)$$

The value of u_i is greater than or equal to zero which is the stochastic random that is considered as the cost inefficiency supposing $v_i \sim iid\ N(0, \sigma_v^2)$ (independently and identically distributed,) $idd\ v_i$ is the random shock which is not the result of cost inefficiency supposing to have the normal distribution and symmetry and $u_i \sim iid\ N^+(0, \sigma_u^2)$, which is non-negative half-normal. Both of v_i and u_i are independent and they are independent from the regressors. Here, we use the model of Cobb-Douglas function to estimate the parameter by maximum likelihood method. u_i and other parameters are derived from the derivative of log-likelihood function as shown in equation (4) comparing to each parameter. Solving all the equations will get all parameters which are the maximum likelihood estimators, then taking all the parameters to estimate an inefficiency of each producer by using ε and u_i to calculate an inefficiency of producer as shown in equation (5)

$$\ln L = \text{constant-}I \ln \sigma + \sum_i \ln \Phi\left(\frac{\varepsilon_i \lambda}{\sigma}\right) - \frac{1}{2\sigma^2}\sum_i \varepsilon_i^2 \qquad (4)$$

I is the number of producer $\sigma = \sqrt{(\sigma_u^2 + \sigma_v^2)}$, $\lambda = \sigma_u/\sigma_v$ is the asymmetric level of distribution, ε_i is the error term that is equal to $v_i - u_i$, Φ is the cumulative function of standard normal distribution and σ_u^2, σ_v^2 is the variance of u and v, respectively.

$$\hat{u}_i = CI_i = \text{E}(u_i|\varepsilon_i) = \frac{\sigma_u \sigma_v}{\sigma}\left[\frac{\phi(\varepsilon_i \lambda / \sigma)}{1 - \Phi(-\varepsilon_i \lambda / \sigma)} + \frac{\varepsilon_i \lambda}{\sigma}\right] \qquad (5)$$

ϕ is the density function of standard normal distribution

The ratio of the cost of production unit i compares with the cost of production on the cost frontier which is the estimation of the equation (3) and gives the cost efficiency between 0 and 1. The cost efficiency of each producer i is calculated from equation (6)

$$CE_i = \mathrm{E}(\exp\{-u_i\}|\varepsilon_i) = \exp(-\hat{u}_i) \qquad (6)$$

2.2 The related research of cost efficiency and the factors affecting cost efficiency

The research studies on cost analysis in agriculture are numerous but most of them study about costs and benefits of investment by focusing on the analysis of financial feasibilities. The analysis about the output and the cost of agriculture products in Thailand will estimate the function of production and cost in order to evaluate the economic efficiency by using various functions, such as Cobb-Douglas, Translog. At the same time, they assume that the producers produce to get a high output at a given production input. In case of the cost, it tries to make the cost lower under allocating input efficiently. In fact, the producer may not have that kind of behavior but some producers are efficient, so some of producers may be inefficient. It means that some producers may not be successful by using lowest input costs to produce the goods and services under existing technology or some producers may have technical efficiency. Even though, the producers have technical efficiency some producers cannot allocate their inputs to obtain the lowest cost under the condition of confronting input prices. So it means that few producers have cost efficiency.

From the mentioned studies, most of the Thai authors will study the technical efficiency of the agricultural producers more than studying about the cost efficiency. In the case of technical efficiency by using the analysis which is called the production frontier, it was the study of Patamasiriwat and Isavilanonda (1990). They studied about the efficiency of agriculturists and found that 47 % of the agriculturists have technical efficiency less than 90% which is not a study about the factors of technical efficiency. Wiboonpongse and Sriboonchitta (2005) had studied about technical efficiency of jasmine rice and non-jasmine rice production found that the technical efficiency were 61% and 63 %. Besides, they found that the important factor effecting in a positive way for the technical efficiency was the ratio of female workers per all workers in the family. The factor of adult workers effects in the negative way for technical efficiency. The other factors are education and the age which seems to be insignificant and is consistent with the study of Songsrirote and Singhapreecha (2005). However, the result of study for some researchers indicates that the important economic and social factors, demographic factors, farm characteristics, environment and others are affecting to the efficiency (Kumbhakar and Bhattacharya, 1992; Ali and Chaundry, 1990). Besides, the factors of saving, income and the supporting agricultural information from the government affect efficiency significantly (Songsrirote and Singhapreecha, 2005).

Management performance of the producers should be considered because it can affect the efficiency, that is, the difference of efficiency is from the variation in management (Kay and Edward, 1994). The empirical studies try to measure the influence over the management on farms or the variation in technical efficiency of farms, such as the study of Battese and Staffs (1996), but they did not bring the perspectives of decision-making process to study. However, the views of decision-making process still appears on the study of Wilson et al. (2001), including Rougoor et al. (1998) which shows that the influence over the management is still very important for the technical efficiency of production units. As mentioned above, it still does not cover all the management characteristics. To bring the view point of planning, organizing, leading and controlling to consideration, it shows the better

management performance of production units. Besides, there are no studies about management performances affecting cost efficiency in Thai sericulture.

The study of factors that influence efficiency may be different by the data, types of goods and other observations. However, the study of technical efficiency is only the assumption that the producers want to produce maximum output, but they don't consider the prices of inputs as the cost frontier does. In addition, the study of factors affecting the cost efficiency is still not taken into account.

3. DATA AND METHODOLOGY

3.1 Data Collection

Data of the input prices and output of sericulture are collected in Roi-Et and Mahasarakham in the year 2007 because there are a lot of agriculturists who are working on sericulture in the North Eastern region of Thailand, such as Khon Kean, Mahasarakham, Roi-Et, Buri Ram and Chayaphum. Queen Sirikit Sericulture Center Roi-Et was contacted for the sampling of farmers who operate sericulture in Mahasarakham and Roi-Et. In Mahasarakham area, Amphoe Borabu was chosen for the survey; which consisted of Tumbon Wangchait, Tumbon Nonrasi and Tumbon Kampee. In Roi-Et area, Amphoe Thawatchaburi was chosen for the survey, consisting of Tumbon Baungnakorn and Tumbon Ummao. Data was randomly collected from 210 farmers who operate sericulture, the details are shown in table 1.

Table 1. Study Area and Size of Samples

Educational Area	Population	Size of Samples
Amphoe Borabu, Mahasarakham		
Tumbon Wangchai	245	65
Tumbon Nonrasi	174	18
Tumbon Kampee	79	37
Amphoe Thawatchaburi, Roi-Et		
Tumbon Buengnakorn	136	60
Tumbon Ummao	46	30
Total	680	210

3.2 Data Analysis

Data analysis is divided into three parts, namely Part-1 is the cost efficiency measurement, Part-2 is the factors affecting cost efficiency and Part-3 is the comparison of management performance of sericulture of high-efficiency and low-efficiency, as the following details:

3.2.1 Cost Efficiency Measurement

Stochastic frontier analysis is used for the cost efficiency measurement which is the single output, but using various inputs. The model is specified as the Cobb-Douglas function, as shown in the equation 7 due to the fact that Cobb-Douglas function is in accord with the data and consistent with the theory more than the other models (Songsrirote and Singhapreecha, 2007; Wiboonponse and Sriboonchitta, 2001;

Kumar, 2001: 51; Taylor and staffs, 1986; Kobb and Smith, 1980; Battese, 1992; Brovo-Ureta and Pinheiro, 1993). u_i namely, the non-negative random distribution which is showing the cost efficiency of each production unit i by $u_i > 0$ and assume for the distribution in the form of half normal or most of production unit will have cost efficiency, v_i is the random error which shows the noise. In addition, C_i, w_2, w_3, and w_4 are normalized by w_1 because the cost function is homogeneous of degree one in input prices it is known that $\sum \beta_n = 1$. Finally, we estimate various coefficients in equation 7 by using maximum likelihood estimation (MLE)

$$\ln \frac{C_i}{w_1} = \beta_0 + \beta_y \ln y_i + \sum_{n=2}^{k} \beta_n \ln \frac{w_{ni}}{w_1} + u_i + v_i \tag{7}$$

Where, C_i = the cost of sericulture (Baht) Production unit i

y_i = cocoon (kilogram)

w_{ni} = cost of production n = 1, 2, 3, 4

The variables of input prices are consisted of:

w_1 = the price of fresh mulberry leaves (Baht / kilogram)

w_2 = the price of silkworm eggs (Baht/plate)

w_3 = the price of building (baht/dwelling)

w_4 = the price of tray of caterpillars (Baht/tray)

3.2.2 Factors affecting cost efficiency

The cost efficiency scores from the item 3.2.1 are employed to formulate the relationship with factors affecting cost efficiency by using Tobit regression due to the value of cost efficiency (CE) lies between 0 to 1, as shown in the equation 8. The definition of variable and unit of measurement are expressed in table 2 and the indicators of management performance, which is modified from research result of Griffin and Ricky (1996), are shown in table 3. The indicators of management performance are measured as rating scale for five levels by asking the agriculturists' behavior for the management performance, as follows: high frequently = 5, often = 4, occasionally = 3, least = 1

$$\begin{aligned} CE_i = {} & \delta_0 + \delta_1 LOC2_i + \delta_2 LOC3_i + \delta_3 LOC4_i + \delta_4 LOC5_i + \delta_5 WORM_i + \delta_6 BR60_i \\ & + \delta_7 HHS_i + \delta_8 RWK_i + \delta_9 EXP_i + \delta_{10} LND_i + \delta_{11} RIN_i +_i \delta_{12} SAV_i + \delta_{13} ACR_i \\ & + \delta_{14} SCA_i + \delta_{15} ATR_i + \delta_{16} GSP_i + \delta_{17} MEM_i + \delta_{18} DIV + \delta_{19} MGT_i + \varepsilon_i \end{aligned} \tag{8}$$

Table 2. Variable and Unit of Measurement

Variable	Definition and Measurement	Expected sign
CE	Cost Efficiency (the score lie between 0 and 1)	
LOC1	1 = Tambon Ummao, 0 = other area	(-) or (+)
LOC2	1 = Tumbon Buengnakorn, 0 = other area	(-) or (+)
LOC3	1 = Tumbon Wangchai, 0 = other area	(-) or (+)
LOC4	1 = Tumbon Rasi, 0 = other area	(-) or (+)
LOC5	1 = Tumbon Kampee, 0 = other area	(-) or (+)
WORM	Silk Breed (1 = Native Breed 0 = other breed)	(-) or (+)
BR60	Fresh Mulberry Leaves Breed (1 = Bor Ror Breed. 60, 0 = other breed)	(-) or (+)
HHS	Size of Family (people)	(-) or (+)
RWK	Number of workers (adult) per members in family (Ratio)	(+)
EXP	Experience in sericulture (year)	(+)
LND	Size of occupied land (Rai)	(+)
RIN	Agricultural income per all income of family (Ratio)	(+)
SAV	Saving of family (Baht)	(+)
ACR	Number of agricultural credit (Baht)	(+)
SCA	Source of agricultural credit (1 = Bank for Agriculture and Agricultural Cooperatives (BBAC). 0 = other source)	(-) or (+)
ATR	Seminar experience, technology, transferring the knowledge of sericulture of the government (times)	(+)
GSP	Guidance, support and promotion of planting mulberry from the government (times)	(+)
MEM	Member of community or agricultural institute(1 = yes 0 = no)	(-) or (+)
DIV	Diversification of agricultural production activities (number of activities)	(+)
MGT	Management performance (mean from rating scale)	(+)

Note: Symbol "+" show the same direction
          Symbol "-" show the opposite direction

Table 3. Indicators of Management Performance (MGT)

Management Performance (MGT)

Planning (pla)

1. The self survey of weakness, strength, opportunity and threat (pla1)

2. Specification of a clearly written objectives (pla2)

3. Using calendar and taking notes as the supporter in working (pla3)

4. Specify the first step and the last day of activities or project (pla4)

5. Asking suggestion from the others to plan for working (pla5)

6. Self data collecting and learning (pla6)

Planning of production

1. Consideration on various production factors using for activity and how to allocate (plp1)

2. Revision of marketing and the need assessment before production (plp2)

Table 3. (continued)

Management Performance (MGT)

3. Considering the profit that is earned from various activities before production (plp3)

Financial Planning

1. Decision how to use investment funds for production (pfn1)

2. Study of various sources of investment funds for production (pfn2)

3. The consideration where to use sources of investment funds (pfn3)

4. The consideration when and how to pay back the investment funds (pfn4)

Personnel Planning

1. The consideration of personnel and the abilities on production (pst1)

2. The calculation of labor need in production (pst2)

Decision

1. Specify the problems or objective for the decision (dmk1)

2. Search for the cause of problem (dmk2)

3. Collecting data for decision (dmk3)

4. Evaluation and analysis for the appropriate choice (dmk4)

Organizing (org)

1. Specify the job for each person and assign up to the skills (org1)

2. Arranging activity and production inputs reasonable and clearly (org2)

Leading (lea)

1. Significance of work, stimulate and persuade the members (family or group of production) for the attempt to the full (lea1)

2. Familiarly, generous and feel for the others (lea2)

3. Advise others the way how to gain up capability (lea3)

4. Encouraging enthusiastic and speaking for the confidence (lea4)

5. Compliment and realize for the success of working attempt (lea5)

6. Reward with a gift for the success (lea6)

7. Inform the member (family or group of production) about the duty, responsibility, the way and the expectation (lea7)

8. To be the counselor or and train the others to be apprentic (lea8)

9. To consult with the others before making decision (lea9)

10. Assign the others the responsibility and the freedom of thinking (lea10)

11. Planning in advance for the activity and working for the efficiency (lea11)

12. Looking for new opportunity and having the new idea for the development (lea12)

13. Support various essential facilities for the subordinate and colleagues for the success (lea13)

14. Collecting the activity's data and checking for success (lea14)

15. Collecting the essential information from the outside for the benefit of work (lea15)

16. Promote and protect the public benefit and manage resources for the public (lea16)

17. Emphasize team working and promote the cooperation of the members (family or group of production) (lea17)

18. No promotion for the conflict, fighting of the members (family or group of production) and problem management with the creative way (lea18)

19. The critic of unacceptable, positive speaking and giving the opportunity for explanation (lea19)

20. The appropriate measure for someone who are not respect to the rules (lea20)

Table 3. (continued)

Management Performance (MGT)
Controlling
1. Specify the standard of working and various activities (ctl1)
2. Measuring the success of work by using the specified standard of each work or activity (ctl2)
3. Comparison or evaluation of the success on the first specified standard (ctl3)
4. Consideration of the right method after the evaluation of success (ctl4)
5. Accounting management on job and various activities (ctl5)
6. Consider the way of improvement to develop the quality of production (ctl6)

3.2.3 Comparison of Measure Performance of Sericulture of High-efficiency and Low-efficiency

This analysis is to bring the cost efficiency of each sericulture from 210 samples and they are sorted in descending order, and then divide the sorted data into four parts. The first part is called "high-efficiency group" and the fourth data is called "low-efficiency group". Thus, there are 53 persons in each group. Take the first group and the fourth group to compare with the average of management performance. T-statistic is employed for the hypothesis test.

4. RESULTS

4.1 Cost Efficiency

The analysis of cost efficiency is considered by using likelihood test. By setting up the hypothesis that there is no cost frontier ($u = 0$). The table 4 indicates coefficient γ is equal to 0.03379. The analysis found the null hypothesis is not rejected at the significance 0.01; it shows the coefficients of cost frontier is not different from the estimation by using ordinary least square (OLS). Table 4 shows the coefficients are positive and has a significant impact on production cost. Cost Inefficiency (u) can be explained only 3.38 %.

Table 4. Analysis of Cost Frontier

Variable	Coefficient	Standard error	Statistics Z
constant	0.9687	5.74936	0.17
$\ln y$	0.3607***	0.06848	5.27
$\ln(w_2/w_1)$	0.5596***	0.15566	3.59
$\ln(w_3/w_1)$	0.3696***	0.11981	3.08
$\ln(w_4/w_1)$	0.3072***	0.09599	3.20
σ_v	1.2249	0.05985	-
σ_u	0.0015	7.11473	-
σ	1.5005	0.14706	-
$\gamma = \sigma_u^2/\sigma^2$	0.0338	-	-

Note: *** Statistics significance at 1%

Cost efficiency indicates most of the sericulture have efficiency or cost efficiency equal to 1. 180 records those are out of 210 records or in the percentage of 85.71. Cost efficiency is greater than 0.90 and less than 1, it's 12.86%. There are 3 records (1.43%) for the cost efficiency is less than 0.40. Besides, the average efficiency of all sericulture is 98.88 % and it means that the sericulture can reduce the cost for 1.12 % and the average efficiency in each area is higher than 90 % that is shown in table 5.

Table 5. Cost Efficiency

Efficiency Score	Roi-Et (90 agriculturists)		Mahasarakham (120 agriculturists)			Roi-Et and Mahasarakham
	Tumbon Ummao	Tumbon Buengnakorn	Tumbon Wangchai	Tumbon Nonrasi	Tumbon Kampee	
1.00	25	52	54	16	33	180
0.90-0.99	5	7	9	2	4	27
0.80-0.89	0	0	0	0	0	0
0.70-0.79	0	0	0	0	0	0
0.60-0.69	0	0	0	0	0	0
0.50-0.59	0	0	0	0	0	0
0.40-0.49	0	0	0	0	0	0
<0.40	0	1	2	0	0	3
Number of farm	30	60	65	18	37	210
Average efficiency	0.9999	0.9883	0.9749	0.9996	0.9999	0.9888
Standard deviation	0.0002	0.0900	0.1426	0.0016	0.000005	0.0930
Lowest-efficiency	0.9985	0.2988	0.1147	0.9932	1.0000	0.1147
Highest-efficiency	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

4.2 Factors Affecting Cost Efficiency

Table 6 shows the factors affecting cost efficiency of the sericulture and it found that factors affecting the cost efficiency at 0.05 of significant level with positive sign are management performance of sericulture, sources of loan from Bank for Agriculture and Agricultural Cooperatives (BBAC). Thus, the key factors are management performance of the sericulture and sources of loan.

However, those variables being insignificant but it signifies positively in the theory are geographical area, namely Tumbon Kampee, the sericulture use native breed of silk and fresh mulberry leaves as Bor Ror.60, household size, number of workers (adult) per members in family, savings, agricultural credit from the bank, agricultural training courses, a member of agricultural group, and various agricultural activities on farm.

Table 6. Factors Affecting Cost Efficiency

Variable	Coefficient	Standard error	Statistics Z
LOC2	-0.01459	0.02491	-0.59
LOC3	-0.03275	0.02625	-1.25
LOC4	-0.00135	0.00903	-0.15
LOC5	0.010085	0.01739	0.58
WORM	0.035933	0.03765	0.95
BR60	0.021117	0.0248	0.85
HHS	0.051468	0.07396	0.70
RWK	0.135547	0.09511	1.43
EXP	-0.02715	0.02049	-1.33
LND	-0.00872	0.03191	-0.27
RIN	0.031574	0.04361	0.72
SAV	0.005395	0.00676	0.80
ACR	0.035817	0.03619	0.99
SCA	0.04807**	0.02303	2.09
ATR	0.016491	0.05535	0.30
GSP	-0.04937	0.05551	-0.89
MEM	0.052166	0.07136	0.73
DIV	0.006491	0.0621	0.10
MGT	0.266963**	0.12124	2.20

Note: [**] Statistics significance level 5%

4.3 Comparison of management performance of sericulture on the high-efficiency group and the low-efficiency group

Comparison of management performance of sericulture on the high-efficiency group and the low-efficiency group found that average of management performance on the high-efficiency group is higher than low-efficiency group at 0.05 of significant level, according to the average of management performance the first 10 sequence as follows:

1) Rewarding with a gift for the success (lea6)
2) Inform the members (family or production group) about the duty, responsibility, the way and the expectation (lea7)
3) Consult with the others before making decision (lea9)
4) Consider the way of improvement to develop the quality of production (ctl6)
5) Looking for new opportunity and having the new idea for the development (lea12)
6) Decision how to use investment funds for production (pfn1)
7) Consideration when and how to pay back the investment funds (pfn4)
8) Specify the job for each person and assign up to the skills (org1)
9) Consideration where to use sources of investment funds (pfn3)
10) Study of various sources of investment funds for production (pfn2)

5. CONCLUSIONS

The study indicates most of the sericulture has high efficiency. The important factor to high up the cost efficiency of sericulture is management performance. The research result found that the important factor that effects the cost efficiency

significantly is the management performance of sericulture which is consistent with the result of study of Kay and Edward (1994), Rougoor et al. (1998), including Wilson et al. (2001). Besides, it found out that the source of loan from Bank for Agriculture and Agricultural Cooperatives (BBAC) lead to the higher cost efficiency. Management performance of sericulture on the high-efficiency group is higher than the low-efficiency groups in planning, leading, organizing and controlling. Therefore, an improvement and development of management performance of sericulture will help sericulture to have the higher cost efficiency.

6. RECOMMENDATIONS

This study indicates the role of management performance of sericulture on cost efficiency. The result of study refers to the following suggestions:

Firstly, an increase in the management performance can be achieved by organizing the project of short training courses in management performance.

Secondly, the higher cost efficiency groups should provide the lower cost efficiency groups with relevant information and knowledge in order to be a best practice to high up the cost efficiency. To make a tour in the area of the higher management performance, such as Tumbon Nonrasi, Tumbon Wangchai and Tumbon Kampee is a strategic way to gain up the high efficiency for the sericulture in the region.

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