Technical Efficiency of Micro and Community Enterprises: Evidence from Dok-Kham-Tai District, Phayao, Thailand

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Abstract
This study is to find what are key factors contributing efficiency of the Dok-Kham-Tai community enterprises. In order to meet this objective question, first, Data Environment Technique (DEA) is applied to calculate the community enterprise efficiency scores. Then, the calculated efficiency scores will be linked and explained by financial and non-financial factors. According to this study, the first stage of DEA calculation shows the efficiencies of Dok-Kham-Tai enterprises are relatively low which is around 0.01 to 0.30. In the second stage, it finds that financial and non-financial factors are both equally important in stimulating the Dok-Kham-Tai enterprise efficiency. Regarding to the financial factors, even though capital per worker is significant and positively relates to the enterprise efficiency, the output per worker turns out to be negatively significant. This negative sign implies, to raise the efficiency, the Dok-Kham-Tai community enterprises need to expand their production possibly in order to get benefit of economy of scale. On the other hand, non-financial factors which are political relationship and gender, female leader, are found to significantly contribute the enterprises' technical efficiency.

Keywords: Efficiency, Community Enterprises, Thailand

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Introduction

Small and Medium Enterprises (SMEs) have an important role in the Thai Economy as its outputs accounts for around 34 percent of the Thai industrial gross domestic products (GDP) and shares around of 67 percent of the Thai industrial employment (Thassannabanjong, *et all*, 2009). However, the report by the Department of Industrial Promotion, Thailand, (2014) shows there is a slow growth of new SMEs registered in last few years. Even though there are 59,499 new registered SMEs, 11,040 SMEs have shut down their businesses which are accounted for 18.40 percent of new registered SMEs in the same year (Office of SMEs Promotion, 2014). Because the SMEs are important to the Thai economy, especially in term of employment, the Thai government has been worried about the slow growth of new registered SMEs and wants to know what causes them to be out of their businesses. The Thai government, therefore, assigns all the universities in Thailand, including the University of Phayao (UP), to study and to answer these questions. As this paper is a part of the project funded by the University of Phayao and Thai Research Fund (TRF), who takes full responsibility with these concerns from the Thai government to study what determines local SMEs' efficiency surrounding the areas where UP is located. As the faculty of Management and Information Sciences (MIS)[1] is part of the UP and has responsibility in Dok-Kham-Tai area, this study, therefore, aims to study what determines efficiency of small and community enterprises in Dok-Kham-Tai district, Phayao, Thailand.

Based on the theory, there are two main factors determining firm efficiency which are financial and non-financial factors (Taticchi *et all*, 2010). Studies show that the financial factors are important in determining firm efficiency (Amornkitvikai and Harvie, 2010; Phan, 2004). However, these factors could not explain all changes in firms' efficiency (Vatcharatham, 2004). Especially in SMEs, non-financial factors such as human capitals and support provided by government seem to be more influent to their success than they are to the larger firms.

Even though studies relating to SMEs efficiency have been conducted in Thailand, they only report which SME or industry has higher efficiency without any explanation of what contribute to its efficiency (Meingchom, 2007: Vatcharatham, 2004). In addition, they use only descriptive statistics which has limitation and has less reliable results. Moreover, studies have been conducted putting not much interest on non-financial factors. Therefore, this study purposes to study what non-financial factors determine local community efficiency besides financial factors in Dok-Kham-Tai District, Phayao province. Besides the financial factors, this study expects non-financial factors to play important role in determining the local community efficiency.

Theory and Literature Review

Theory
DEA (Data Environmental Analysis) is a standard technique and has been developed to study efficiency by comparing an amount of output and inputs used. At the same amount of input used, firms which have higher output would show that they have a higher efficiency (Coelli *et all*, 1998). Generally, the technical efficiency can be

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organized into two categories; (i) technical efficiency and (ii) allocative efficiency. The technical efficiency means a firm can produce highest output from its limited input while the locative efficiency means the good ability of firm in re-allocating their inputs at various prices (Coelli, 1997: Farrell, 1957). To measure efficiency, Fare and Grosskopf (1985) and Lovell (1994) first apply the concept of production possibility frontiers (PPF) and this methodology has been developed into two main techniques called (i) Data Envelopment Analysis (DEA) and (ii) Stochastic Frontiers Analysis (SFA)[2]. Both techniques are based on the linear programming concepts in which they try to maximize output under labor and capital constrains, and under the assumption that production function is a constant return to scale (Coelli and Perelman, 1996: Hanhiran, 2014). In order to understand the difference between these terms, it is useful to consider the production process in which a single input (x) is to produce a single output (y). In Figure 1 the line OF' represents a production frontier that defines an association between input and output. The production frontier indicates the maximum output achievable from each input level. This reflects the current state of technology in an industry. If the firm operates on the frontier it is technically efficient. However, if the firm operates below the frontier it is not technically efficient. Point A in Figure 1 represents an inefficient point whereas points B and C represent efficient points. A firm that operates at point A is inefficient but it can increase output to the level associated with point B without requiring more inputs, or it can produce the same level of output utilizing less input by producing at point C (Coelli et *all*., 2005).
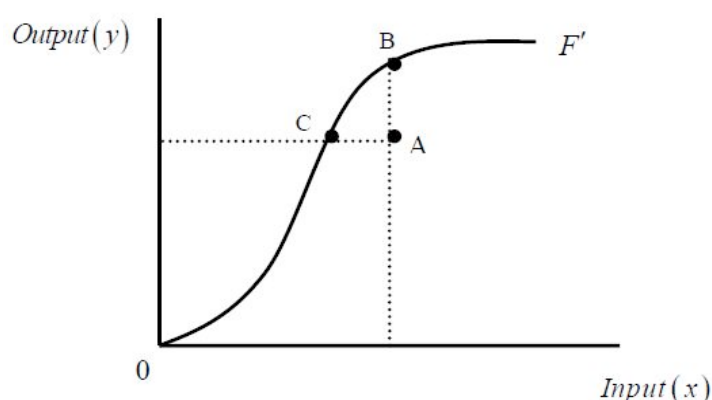

Figure 1[3]: Production Frontier and Technical Efficiency

Literature Review

Palee *et.all.,* (2007) study the technical efficiency in producing sticky rice in Chiang Mai province by using 2000/2001 data. There are 100 observations collected from farmers in Hang-Dong, and San-Pa-Tong districts. Using SFA and DEA, they find that average value of calculated efficiency is 0.71. And, 60 percent of farmers in this area are found to have high efficiency between 0.7001-0.8000. Around 20, 13 and 7 percent of farmers have calculated efficiency scores around 0.5001-0.7000, 0.8001-1.000, 0.3001-0.5000, respectively. In addition, this study shows that the efficiency is mainly determined by farmers' experience and their production skills. In order to

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[2] The SFA technique will not be used in this study.
[3] Coelli *et all*. (2005, p 4)

increase the efficiency, training, therefore, is important to improve their skill in growing rice in the areas of the study. In addition, they explain that consultants are important, expected to help the farmers while facing production problems in order to raise their efficiency.

Meingchom (2550) studies what factors relate to industrial efficiency. In her study, she focuses on the small and medium in 4 sub- industrial sectors based on the ISIC (International Standard Industrial Classification) which are 2511, 2519, 2520 and 2610. The efficiency is calculated from total asset and labour cost, comparing to their outputs. This study finds that the average efficiency is around 0.174-0.642 which is relatively low. The low efficiency is caused mainly by a poor management and too much inputs/inventory carrying.

Wiboonchutikula (2002) investigates trends in the SME sector in Thailand, focusing on employment, export ability and subcontracting activity. The data used in this study is from industrial census data conducted by the National Statistical Office (NSO) of Thailand in 1997. The author utilizes the technical efficiency and total factor productivity (TFP) as the measure to analyze the productivity of SMEs. The translog frontier production function is used to estimate technical efficiency indices. This study shows that over the period 1987-1996, the SME share of overall employment has declined from 60 percent to 52 percent. This can particularly be noticed for the small firm category, which is for firms with less than 10 employees. This perspective is explored further by considering small firm employment shares in three sub-periods with varying overall economic growth rates. It shows that when overall economic growth is high the share of small firms seems to contract, possibly because the several small firms turn to medium sized and others separate because the owners can discover more remunerative works in larger firms. However, during the slower growth rate periods the proportion of employment in the small firms tends to increase, because the larger firms may hire less new employees or downsize or lay off employees

Arunsawadiwong (2007) studies productivity trends in the Thai manufacturing sector. The author employs a stochastic frontier analysis (SFA) to measure the pre and post financial crisis technical efficiency levels of the Thai manufacturing sector. The periods for estimations can be divided into two sub-periods, (i) pre-crisis during 1990 to 1996 and (ii) post crisis during 1997-2002. The results show that the overall efficiency of the manufacturing sector improved in the post crisis period, compared with the pre crisis period. In the post crisis period, the technical efficiency is found to change from year to year. This indicates that the manufacturing sector becomes more attentive in improving its efficiency, as compared with the pre crisis period that experiences no obvious technical efficiency improvement. The findings indicate that a structural shift in the Thai manufacturing sector occurs, from being labour intensive in the pre crisis period to being capital intensive in the post crisis period. The level of productivity improves in the post-crisis period when compared to the pre-crisis level. The low productive investment level in the pre-crisis period is recognized as the main factor that lead to a decline in the efficiency of the manufacturing sector. It is concluded that this low productivity level causes a decline in Thai manufacturing sector competitiveness.

Data and Methodology

Data

The community entrepreneurs' data used in this study come from the survey conducted in 2014 in Dok-Kham-Tai District, Phayao, Thailand. The local community enterprises' data such as type of industry, addresses and owners are provided by Dok-Kham-Tai Community Development Department which takes full responsibility in taking care of the local community enterprises. In this study, the author tries to correct the data from all registered firms in Dok-Kham-Tai. Totally, there are 70 registered community enterprises. However, the data of only 31 firms can be reached. As the local community enterprises run their business with poorly financial and data record, therefore, is roughly estimated and provided by community enterprises' leaders. To avoided unreliability of statistical estimation in this study, Bootstrapping is brought into this study. This technique is normally applied when a number of observations are relatively low.

Methodologies

Methodologies used in this study are called "Two Stage DEA (Data Environment Analysis: DEA)". Therefore, to obtain the result to answer the hypotheses in this study, there are two steps. First, an efficiency will be calculated based on revenue, capital and workers employed in those firms. The calculated technical efficiency is between 0.00-1.00 in which 0 = least efficiency while 1 = highest efficiency. Second, after the calculated efficiency for each firm is achieved, they will be regressed on financial and non-financial factors. As the dependent variable has value between 0 and 1, Tobit Regression will be applied. The result from this second stage will be useful and used to answer the objectives of this study. DEA and Tobit Regression model can be shown in the following sections.

Model Specification

Tobit Model is to find the relationship between a dependent variable and explanatory variables whether significantly relates. The Tobit model is normally applied when the dependent variable has value between 0 and 1. As DEA technical efficiency calculated (DEA) is a number between 0 and 1, the Tobit model is the most appropriate model for this study. In this study, Calculated DEA will be assumed to depend on the financial and non-financial variables which can be shown as following,

$$DEA_j = \alpha + \beta_i X_{ij} + \gamma Z_{ij} + \varepsilon_i \qquad \textbf{(1)}$$

Where DEA_j = Technical efficiency calculated from the first stage which are between 0 and 1, industry j

α = Constant value

β = X_{ij} coefficients

X_{ij} = financial factors which are output per workers, output-capital ratio and capital-worker ratio

γ = Z_{ij} coefficients

Z_{ij} = Non-financial factors which are industries, locations, leader characteristics such as gender,

education,   training,   political   relationship   and
government's supports

Empirical Results

Technical Efficiency
From the DEA analysis, the local community enterprises' efficiency can be obtained
and shown in Table 1. Even though the technical efficiency scores vary across
community enterprises in this study, the food and textile industries are found to be
most effective, having technical efficiency score at level 1, following by a cosmetic
industry.

Observations	Ranking	Technical Efficiency	Industry
19	1	1.000	food
30	1	1.000	textile
12	3	0.337	food
23	4	0.282	textile
10	5	0.242	cosmetic
2	6	0.237	food

Note: Values in the tables are from calculation
Table 1 : Calculated Technical Efficiency of Local Community
Enterprises in Dok-Kham-Tai District, Phayao

Over all, this study finds that the technical efficiency of local community enterprises
in Dok-Kham-Tai district is relatively low. The average value is only 0.2. In the next
section, this study will link the calculated technical efficiency to be explained by the
financial and non-financial factors. It is expected to help in answering the main
purpose of this study what determines the technical efficiency of local community
enterprises in Dok-Kham-Tai district.

Empirical Results from the Tobit Regression
Table 2 shows the Spearman correlation between independent variables in this study.
It is found that correlations among independent variables in this study are relatively
low. Therefore, multicolinearity between variables is not problems in this study.

Variables	OPW	KPW	OPK	Age	Politic	Experience	Gender
OPW	1.00						
KPW	0.37 (0.05)	1.00					
OPK	0.23 (0.24)	-0.70 (0.00)	1.00				
Age	0.13 (0.49)	0.14 (0.47)	-0.01 (0.94)	1.00			
Politic	-0.01 (0.93)	-0.19 (0.33)	0.13 (0.51)	0.04 (0.82)	1.00		

Experience	0.09 (0.64)	0.17 (0.39)	-0.01 (0.95)	0.18 (0.36)	-0.76 (0.00)	1.00	
Gender	0.20 (0.32)	0.23 (0.24)	-0.12 (0.55)	0.43 (0.02)	0.21 (0.28)	-0.05 (0.79)	1.00

Table 2: Spearman Correlation
Note: A number in the blanket show level of significance.

The result from Tobit regression can be shown in question 2. Regarding to the financial factors, it shows that OPW significantly determines DEA. However, it has a negative relationship which means if holding other variables constant and if OPW increases a percent, DEA will decrease around 32.09 percent. Simple explanation is that if the local entrepreneurs try to raise output relative to workers, it will cause them to be less efficiency. On the other hand, if KPW and OPK increase one percent, the efficiency will increase by 32 percent. The former means capital is the main factor contributing local efficiency while the later means, if they use their capital to produce more product, the efficiency will increase.

$$\text{DEA} = 0.0007(\text{AGE}) - 0.293\ (\text{Man})^{**} -32.0944(\text{lnOPW})^* +32.0991(\text{lnKPW})^*$$
$$(0.0007)^4 \quad (0.1270) \quad (18.3374) \quad (18.3640)$$

$$+32.0205\ln(\text{OPK})^* +0.4286\ (\text{Politic})^* +0.3803\ (\text{Experience}) \quad (2)$$
$$(18.3448) \quad (0.2672) \quad (0.2792)$$

Regarding to the non-financial factor, gender of the leader are significant affecting enterprise efficiency. In this study, gender is a dummy variable in which male = 1, female = 0. According to equation 2, male leader will cause a local enterprise to have 0.293 efficiency score lower than female leader does. Then, the enterprises which have political relationship (Politic variable) are also significantly contributing the local community enterprise efficiency. The enterprises which have political relationship are expected to gain helps such as marketing supports, funding and training, and to have the higher efficiency. However, age of the leader and experience of the leader seems to have no effect local community enterprise's efficiency as they were expected.

Conclusion

According to this study, in the first stage, it finds that Food and Beverage firms in Dok-Kham-Tai are the most effective business. Then, there are Craft, Textile, Cosmetic industries, respectively. Over all, the local community enterprises have low efficiency with average value around 0.20. In the second stage, technical efficiency calculated from DEA method which is used as dependent variable is linked to explain by financial factors and non-financial factors by applying Tobit Regression. It finds that the financial factors significantly determined the local community enterprises' efficiency. Besides, the non-financial factors which are gender, political relationship, are also found to be important. Increasing output relative to employment is surprisingly found to reduce local community efficiency. This is caused by that they do not have benefit from economy of scale. So, the expansion of production will help

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[4] Number in the blanket show bootstrap standard error.

them to be more effective and raise the efficiency. However, increasing output relative to capital and increasing capital relatively employment is found to increase the local community efficiency. So, raising output by more utilizing capital is essential, helping the local community enterprises to increase the efficiency.

Non-financial factors which are political relationship and gender are found to have significant in determining local community efficiency. Regarding to the political relationship which is found significant, the explanation for this is that local political institutions or local government organizations have provided the local enterprises, marketing support, funding and training. Therefore, enterprises with political relationship tend to have higher efficiency.

Besides, a female leader is found to contribute higher efficiency to the local community enterprises than a male leader do. This might relate to type of local businesses themselves which mainly are feminine business such as food, textile cosmetic businesses, for example. They are likely complement to women, rather than men. For the further study, the ambition which tries to explain what causes them to shut themselves down and out of their business becomes very interesting issues. Therefore, continuous data correction is important as every year there is existence of new and closed businesses.

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