Do Dairy Cooperatives perform their Own Business with the Technical Efficiency?: The Evidence from Dairy Cooperatives in Nakhon Ratchasima Province Area, Thailand.

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Abstract

Since 1962, when the first dairy farming in Thailand has been started, Thai dairy farmers have adopted dairy farms as their career of living. They gathered themselves as a dairy cooperative for business operation. Until now, dairy cooperatives have never known that they performed their own business with technical efficiency or not. In this paper, the researcher attempted to answer this question with the research objective to analyze the technical efficiency of dairy cooperatives in the Nakhon Ratchasima province area. This research focused on quantitative analysis. Times-series and cross-sectional data were collected from the cooperative auditing department database from 10 dairy cooperatives from 2008 to 2020. 130 observations were selected, and data analysis was applied to the panel data econometrics model to analyze the dairy cooperatives' technical efficiency.

The findings found that the overall average of 10 dairy cooperatives in the Nakhon Ratchasima province area obtained a very high performance of technical efficiency score of 0.98 whereas 2 out of 10 dairy cooperatives performed their own business with their outstanding technical efficiency score of 1.000 and 1.000, respectively. There is a tendency to increase the number of dairy farmers in Nakhon Ratchasima province, which indicates that the production of raw milk by dairy cooperatives tends to increase in response to the increased demand for milk and dairy products of domestic consumption. Also, the dairy cooperatives' business performance still needs government assistant both academic and financial supports.

Keywords**:** *Dairy Cooperatives, Technical Efficiency, Nakhon Ratchasima Province*

1. Introduction

Agriculture has long been the basic and crucial sector of the Thai economy. One of the agricultural production sectors is dairy farming. It is known as a class of agriculture for cow milk long-term production processing on the farm for a dairy product eventual sale. More than 65 percent of dairy farming owners have a single career as farmers, they do not have other second careers for a living (The Encyclopedia for Youth by His Majesty the King, 2018).

Historically, dairy farming in Thailand began in 1962 when His Majesty King Rama IX of known as King Bhumibol Adulyadej has established the Thai-Danish dairy training center at Muak Lek District, Sara Buri province with the cooperation of the King Frederick IX of Denmark. They set up the dairy farming training center for farmers. It has later developed into the Dairy Promotion Organization of Thailand with its status as a state enterprise under the Ministry of Agriculture and Cooperatives (The Encyclopedia for Youth by His Majesty the King, 2018; Sutasinee, 2014).

In Thailand, dairy farmers in Thailand Often gathered to register as a legal entity in the form of a dairy cooperative distributed in every region in Thailand. The dairy cooperatives in Thailand are an important source of protein feed to meet the consumption needs of milk consumers and dairy products that are a source of protein and other essential and useful nutrients for people of all ages in Thailand (Cooperative Auditing Department, Ministry of Agriculture and Cooperatives, 2018; Senphong, 2008), as shown in Table 1.

From Table 1, in 2021, there are 98 Dairy Cooperatives in Thailand with a total membership of 19,638 people, with a business volume of dairy cooperatives of 19,667 million baht. The dairy cooperatives' revenue was 24,968 million baht and their profit was 484 million baht. Also, the operating capital of dairy cooperatives was 16,949 million baht. The dairy cooperative assets showed 18,949 million baht with their investment of 29.57 million baht. It is important in the Thai economy to income and employment (Cooperative Auditing Department, Ministry of Agriculture and Cooperatives, 2018).

Table 1 Performance of Dairy Cooperatives in Thailand 2021

Dairy cooperative information	Number of units	Number of dairy cooperatives
Number of dairy cooperatives	98	cooperatives
The number of members	19,638	persons
Business volume	19,667,877,894.08	baht
Income	24,968,224,515.89	baht
Profit	484,972,273.38	baht
Operating capital	16,949,524,796.49	baht
Assets	18,949,524,796.49	baht
Investments	29,579,741.95	baht

Source: Cooperative Auditing Department, Ministry of Agriculture, and Cooperatives (2021).

Nakhon Ratchasima province is one of the important areas of dairy production in Thailand. According to the data of the Cooperative Auditing Department, Ministry of Agriculture and Cooperatives (2021) to express the dairy production data of Nakhon Ratchasima province shown in Table 2, which can be displayed as follows (Cooperative Auditing Department, Ministry of Agriculture and Cooperatives, 2018).

Table 2 List of Dairy Cooperatives in Nakhon Ratchasima Province

Number	Name of Dairy Cooperative	Number of members
1	Khonburi Dairy Cooperative Limited	58
2	Thai-Danish Dairy Cooperative Sungnoen Limited	164
3	Thai-Danish Dairy Cooperative Dairy Limited	65
4	Thai-Danish Dairy Cooperative Pak Chong Limited	62
5	Pak Chong Dairy Cooperative Limited	480
6	Kham Thale So Dairy Cooperative Limited	120
7	Phimai Dairy Cooperative Limited	179
8	Chumpuang Dairy Cooperative Limited	44
9	Soeng Sang Dairy Cooperative Limited	56
10	Sikhio Dairy Cooperative Limited	52
11	Dan Khun Thot Dairy Cooperative Limited	89
12	Phon Krang Dairy Cooperative Limited	36
Total	**12 cooperatives**	**1,405**

Source: Cooperative Auditing Department, Ministry of Agriculture and Cooperatives (2021).

From Table 2, it was found that there are 12 dairy cooperatives in Nakhon Ratchasima province with a total number of 1,405 members. Besides, dairy farming promotion for farmers in Nakhon Ratchasima province has been promoting dairy farming for more than 20 years. It began to promote the first dairy farming there; however, the general operation of dairy cooperatives now consists of 6 businesses: 1) raw milk collection and distribution business, 2) production and distribution of pasteurized milk, 3) product sourcing business, 4) credit business, 5) service business, and 6) animal feed production business (Cooperative Promotion Department, Ministry of Agriculture and Cooperatives, 2021).

Over 25 years, the dairy production of farmers in Thailand has never considered whether they performed their dairy farming with technical efficiency or not, especially the dairy farming in Nakhon Ratchasima province, one of the important production areas of Thailand (Inthira,1991). Also, the research results of Nakhon Ratchasima province will be the prototype of technical efficiency measurement for other dairy farming areas in Thailand (Kanjanapak, & Tungkasmit, 2017; Kaewkerd, 1989). In this research, the researcher attempted to answer the question “Do Dairy Cooperative performed their own business with technical efficiency?” with the shreds of evidence from Dairy Cooperatives in Nakhon Ratchasima Province Area, Thailand.

2. Objectives

To analyze the technical efficiency of dairy cooperatives in the Nakhon Ratchasima province area

3. Materials and Methods

The population used in this study was 12 dairy cooperatives in Nakhon Ratchasima province from the fiscal year 2008-2020. Secondary data were collected from the database of the Cooperative Auditing Department, Ministry of Agriculture and Cooperatives as in Table 3.

Table 3 Study Population

Order	Name of Dairy Cooperative	Number of members
1	Khonburi Dairy Cooperative Limited	58
2	Thai-Danish Dairy Cooperative Sungnoen Limited	164
3	Thai-Danish Dairy Cooperative Dairy Limited	65
4	Thai-Danish Dairy Cooperative Pak Chong Limited	62
5	Pak Chong Dairy Cooperative Limited	480
6	Kham Thale So Dairy Cooperative Limited	120
7	Phimai Dairy Cooperative Limited	179
8	Chumpuang Dairy Cooperative Limited	44
9	Soeng Sang Dairy Cooperative Limited	56
10	Sikhio Dairy Cooperative Limited	52
11	Dan Khun Thot Dairy Cooperative Limited	89
12	Phon Krang Dairy Cooperative Limited	36
Total	**12 cooperatives**	**1,405**

Source: Cooperative Auditing Department, Ministry of Agriculture, and Cooperatives (2021).

The sample cooperatives were selected using the purposive sampling technique as conditions were 1) the sample co-operatives must have no negative or zero performance and 2) the data obtained must be relevant and continues. Continuous-time series data with such conditions obtained a sample of 10 cooperatives as shown in Table 4 (Andrews. et al., 2007). Since 2 dairy cooperatives did not meet the requirement of purposive sampling conditions, which were: 1) Dan Khun Thot Dairy Cooperative Ltd. and 2) Phon Krang Dairy Cooperative Ltd., thus, these 2 dairy cooperatives were cut out from the sample size.

Table 4 Samples used in the study

Order	Name of dairy cooperative	number of members
1	Khonburi Dairy Cooperative Limited	58
2	Thai-Danish Dairy Cooperative Sungnoen Limited	164
3	Thai-Danish Dairy Cooperative Dairy Limited	65
4	Thai-Danish Dairy Cooperative Pak Chong Limited	62
5	Pak Chong Dairy Cooperative Limited	480
6	Kham Thale So Dairy Cooperative Limited	120
7	Phimai Dairy Cooperative Limited	179
8	Chumpuang Dairy Cooperative Limited	44
9	Soeng Sang Dairy Cooperative Limited	56
10	Sikhio Dairy Cooperative Limited	52
Total	**10 cooperatives**	**1,280**

Source: Cooperative Auditing Department, Ministry of Agriculture and Cooperatives (2021).

According to Table 4, there were 10 dairy cooperatives in Nakhon Ratchasima province selected from 2008 to 2020. 13 years of time-series data and 10 cross-sectional data were collected with a total of 130 observations for the econometric analysis.

Data analysis

The researcher established the income equation of the 10 dairy cooperatives over 13 years (from the fiscal year 2008-2020) by using a panel data econometric model with a fixed effect panel data model according to the following equation (Khum Bua,1999; Mueankaew, Tanthanawat, & Chatrakhom, 2019; Chaowakul, Nittiyachat, & Netyanan, 2016; Baltagi, 2008).

$$\hat{y}_{it} = \hat{\beta}_{0,it} + \hat{\beta}_{1,it} * x_{1,it} + \hat{\beta}_{2,it} * x_{2,it} + \hat{\beta}_{3,it} * x_{3,it} + \hat{\beta}_{4,it} * x_{4,it}$$

Where:

$\hat{y}_{it}$ = income of the dairy cooperative i. Year t.
$\hat{\beta}_{0,it}$ = Constant Term of the dairy cooperative i.year t.
$\hat{\beta}_{1,it}$ = Estimated Parameter of Dairy Cooperative Liabilities, i.year t.
$\hat{\beta}_{2,it}$ = Estimated Parameter of the cost of the dairy cooperative i. Year t.
$\hat{\beta}_{3,it}$ = Estimated Parameter of the credit of dairy cooperatives i.year t.
$\hat{\beta}_{4,it}$ = Estimated Parameter of Dairy Cooperative Loan i.year t.
$x_{1,it}$ = Liabilities of the dairy cooperative i. Year t.
$x_{2,it}$ = Cost of the dairy cooperative i. Year t
$x_{3,it}$ = Credit from Dairy Cooperative i. Year t.
$x_{4,it}$ = Loan of the Dairy Cooperative i. Year t.

i.= 10 dairy cooperatives in the area of Nakhon Ratchasima province i. = 1, 2,…, 10
t. = Annual data from 2008 - 2020 for 10 years t. = 1, 2,…, 10

The technical Efficiency defined as:

$$\left(\frac{\gamma_{it}}{\gamma *_{it}}\right)$$

(Chayapipatphen, et al., 2014; Chandrani,1993; Ngamsa-ard, 2008; Prueksakunan, 2007).

Where:

γ_{it}= income of dairy cooperative i. Year t

$\gamma *_{it}$ = Income of Dairy Cooperative i. Year t from Estimated Equation By assessing the operational efficiency as follows:

Table 5. The Technical Efficiency Rating Value

The Technical Efficiency Rating Value	Explained
0.8001 – 1.000	Very high performance
0.6001 – 0.800	High performance
0.4001 – 0.600	Medium efficiency
0.2000 – 0.400	Low efficiency
0.0010 – 0.200	Very low efficiency
0.000	Inefficient

Source: Puripunpinyoo, A. (2018). Analysis of efficiency and factors affecting the performance of agricultural cooperatives in the upper central region.

4. Results and Discussion

An analysis of the technical operational efficiency of the 10 dairy cooperatives in the Nakhon Ratchasima area is described as follows.

Table 6. The Technical Efficiency Analysis of 10 Dairy Cooperatives in Nakhon Ratchasima Province

No.	Name of Dairy Cooperative	Efficiency Value Eff = (Y)/(Y*)
1	Phimai Dairy Cooperative Limited	1.000
2	Pak Chong Dairy Cooperative Limited	1.000
3	Thai-Danish Dairy Cooperative Sungnoen Limited	0.998
4	Saeng Sang Dairy Cooperative Limited	0.997
5	Kham Thale So Dairy Cooperative Limited	0.992
6	Thai-Danish Dairy Cooperative Pak Chong Limited	0.990
7	Sikhio Dairy Cooperative Limited	0.980
8	Chumpuang Dairy Cooperative Limited	0.969
9	Khonburi Dairy Cooperative Limited	0.952
10	Thai-Danish Dairy Cooperative Dairy Limited	0.952
Average		**0.985**

Source: Calculation

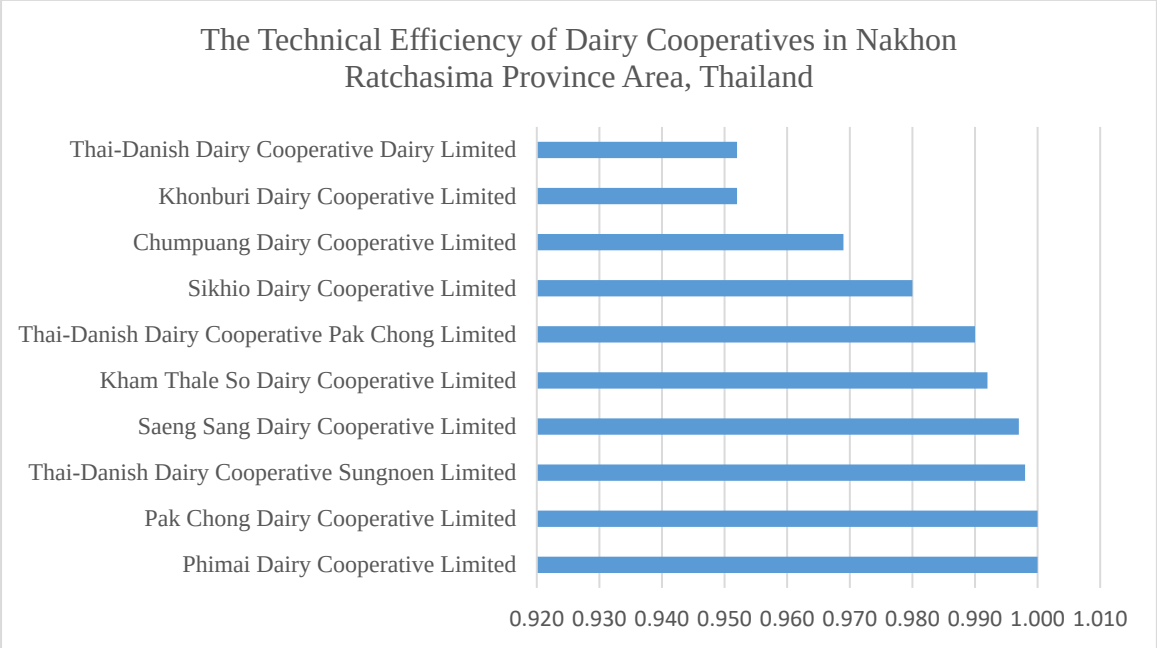

Figure 1 The Technical Efficiency Score of 10 Dairy Cooperatives Limited in Nakhon Ratchasima Province, Thailand.

According to Table 6 and Figure 1, the average technical efficiency score of dairy cooperatives in Nakhon Ratchasima province was 0.980, meaning that all of the 10 dairy cooperatives performed their own business with very high performance. Out of 10, two dairy cooperatives performed their own business with the outstanding technical efficiency score, namely Phimai Dairy Cooperative Limited and Pak Chong Dairy Cooperative Limited, with the technical efficiency score of 1.000 and 1.000, respectively. The others obtained technical efficiency scores ranged from 0.998 to 0.952, which expressed that all of them performed their own business in the good shape. So, the evidence showed that all of the 10 dairy cooperatives in Nakhon Ratchasima province as the study area performed their own business with very high performance (Suriya, 2015; Senphong, 2008; Sinphan, 2016).

According to the research results, it expressed that the trend of dairy cooperatives performance would be trended to be one of the good agricultural careers in Nakhon Ratchasima province and Thailand. There is a tendency to increase the number of dairy farmers in Nakhon Ratchasima province, which indicates

that the production of raw milk by dairy cooperatives tends to increase in response to the increased demand for milk and dairy products of domestic consumption. Besides, the dairy cooperatives' business performance still needs government assistant both academic and financial supports. Furthermore, the dairy farming and farmers in Thailand should have supports from the Thai government to encourage raw dairy production and the domestic demand for milk in Thailand since Milk is the essential protein for all of Thai consumers' generation (Senphong, 2008; Suriya, 2015).

5. Conclusion

According to the research results, the researcher can conclude the research question "Do Dairy Cooperatives performed their Own Business with the Technical Efficiency?" With the evidence and research outcomes from the Dairy Cooperatives in Nakhon Ratchasima province of Thailand as the study area, in sum, all of the 10 dairy cooperatives performed their own business with technical efficiency. For further research suggestions, the research should be conducted in other areas where dairy cooperatives are located, such as Saraburi, Chaing Mai, and others, to analyze the technical efficiency of dairy cooperatives performance (Suriya, 2015; Senphong, 2008; Sinphan, 2016). The results would be beneficial for the new dairy farmers and dairy cooperative to decide whether or not to perform their dairy farming.

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