



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 adopted dairy farms as their career of living. They gathered themselves as a dairy cooperative for business operation. Till now, dairy cooperatives have never known that they performed their own business with technical efficiency or not. In this paper, the researcher attempted to research to answer this question with the research objective to analyze the technical efficiency of dairy cooperatives in the Nakhon Ratchasima province area. The research focused on quantitative analysis. Times-series and cross-sectional data were collected from the cooperative auditing department database from 2008 to 2020 and 10 dairy cooperatives. It turned out of 130 observations selected. 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. There were 2 out of 10 dairy cooperatives who performed their own business with their outstanding technical efficiency score of 1.000. There is a tendency to increase the number of dairy farmers in Nakhon Ratchasima province. This indicates that the production of raw milk by dairy cooperatives tends to increase to respond 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

Thailand is one of the agricultural production countries in the world. A part of the Thai economy is based on the agricultural sector. It serves both the agricultural and non-agricultural sectors. Agriculture has long been the basic and crucial sector of the Thai economy. In the past, rice production and other economic crops have been produced as domestic consumption and export. Nowadays, the agricultural production pattern in Thailand has been changed. Since the Thai economy is no longer dependent on the agricultural sector. 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). Since dairy farm job is labor-intensive. Most of the time, farmers spend their works in their dairy farms to produce raw cow milk. They did not know that they produce their products with efficiency or not.

Historically, livestock careers in Thailand began with animal labor on the farm such as cattle and buffalo for farming. There are some animal feeding such as chicken other poultry produced for family consumption. Dairy farming in Thailand began in 1962. 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 D. (2014). (Sutasinee D., 2014). Since then, dairy widespread in all regions of Thailand as the source of income and employment.

In Thailand, dairy farmers in Thailand often gathered to register as a legal entity in the form of a dairy cooperative expanded in other regions in Thailand, dairy products in Thailand are an important source of protein feed to meet the consumption needs of milk consumers. Also, dairy products 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. 2021) (Senphong. N.,2008), According to the auditing department data, the dairy



product value expressed its significance of Thai economy especially in the agricultural sector which can be shown in Table 1

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	655,595,929.80	\$
Income	832,274,150.53	\$
Profit	16,165,742.45	\$
Operating capital	564,984,159.88	\$
Assets	631,650,826.55	\$
Investments	985,991.40	\$

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

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 \$655,595,929.80. The dairy cooperatives' income was \$832,274,150.53. The dairy cooperatives' profit was \$16,165,742.45. Also, the operating capital of dairy cooperatives was \$564,984,159.88. The dairy cooperative assets showed \$631,650,826.55 with their investment of \$985,991.40. The empirical data of the performance of dairy Cooperatives in Thailand expressed the crucial role of dairy farm business in the Thai economy in terms of investment, income, and employment. (Cooperative Auditing Department, Ministry of Agriculture and Cooperatives. 2018).

Over 20 years, Nakhon Ratchasima province is one of the important areas of dairy production in Thailand. It is the 2nd rank of dairy production area in Thailand. Since Nakhon Ratchasima province is the suitable area for dairy farming in terms of climate and geography. 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. 2021).

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, over 20 years, the dairy farming promotion in Nakhon Ratchasima



province has been implemented. It began to promote the first dairy farming there; however, the general operation of dairy cooperatives 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 not considered how they performed their dairy farming with the technical efficiency or not especially the dairy farming in Nakhon Ratchasima province which has been one of the important productions areas of Thailand (Inthira H.,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, Y. & Tungkasmit, S., 2017). (Kaewkerd, P.,1989). In this research paper, 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. The research methodology and data analysis have followed the study of A.Wittayakorn-Puripunpinyoo (2018, 2020) Who studied the operational performance and efficiency of a dairy cooperative in Nakhon Ratchasima province. The main purpose of this study is to follow the research results of dairy cooperatives’ technical efficiency in Nakhon Ratchasima when the time dimension changed. By doing that the researcher attempted to add up the 2 years of time series dairy cooperatives data of income, liabilities, cost, credit, and loan. The main purpose of the study is to monitor the situation when all 2-year input factors changed, then what happened to the technical efficiency. In another word, when the time dimension has been changed, Do dairy farmers still perform their business operations in the same shape or not.

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 shown in Table 2.

The sample cooperatives were selected applying 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 3. (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. So, these 2 dairy cooperatives were cut out of the sample size.

Table 3 Samples used in the study

Order	Name of dairy cooperative	number of members
1	Khonburi Dairy Cooperative Limited	58
2	Thai-Danish Dairy Sungnoen Cooperative Limited	164
3	Thai-Danish Dairy Cooperative Limited	65
4	Thai-Danish Dairy Pak Chong Cooperative 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 3, 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 and 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 equation Following (Khum Bua, K.,1999). (Mueankaew, J., Tanthanawat, S., & Chatrakhom, S., 2019). (Chaowakul, M., Nittiyachat, T. & Netyanan S., 2016). (Baltagi, B. H., 2008), (A.Wittayakorn-Puripuninyoo, 2018, 2020).

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

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 $i = 1, 2, \dots, 10$

t = Annual data from 2008 - 2020 for 10 years $t = 1, 2, \dots, 13$

The total numbers of observation was $i * t = 10 * 13 = 130$ observations

The technical Efficiency defined as:

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

(Chayapipatphen T. et al., 2014). (Chandrani, S.,1993). (Ngamsa-ard, A.,2008). (Prueksakunan, W., 2007). (A.Wittayakorn-Puripuninyoo, 2018, 2020)

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.

According to the work of A.Wittayakorn-Puripuninyoo, (2018, 2020). Who identified 6 score levels of technical efficiency which were 1) from 0.8001 to 1.000 defined as very high performance, 2) from 0.6001 to 0.800 defined as high performance, 3) from 0.4001 to 0.600 defined as medium efficiency, 4) from 0.200 to 0.400 defined as low efficiency, 5) from 0.0010 to 0.200 defined as very low efficiency, and 6) 0.00 defined as inefficiency.

4. Results and Discussion

An analysis of the technical operational efficiency of the 10 dairy cooperatives from 2008 to 2020 in the Nakhon Ratchasima area could be described as follows:

The average technical efficiency score of dairy cooperatives in Nakhon Ratchasima province was equal to 0.980. This meant that all of the 10 dairy cooperatives performed their own business with very high performance. There were 2 out of 10 dairy cooperatives who performed their own business with a very high technical efficiency score (A.Wittayakorn-Puripuninyoo, 2018, 2020) which were: 1) Phimai Dairy Cooperative Ltd, and 2) Pak Chong Dairy Cooperative Ltd. with the technical efficiency score of 1.000. The others obtained technical efficiency scores ranged from 0.998 to 0.952 which expressed very high



performance (A.Wittayakorn-Puripunpinyoo, 2018, 2020). There were 8 out of 10 dairy cooperatives in Nakhon Ratchasima province which were: 1) Thai-Danish Dairy Sungnoen Cooperative Ltd. obtained its technical efficiency score of 0.998, 2) Saeng Sang Dairy Cooperative Ltd. obtained its technical efficiency score of 0.997, 3) Kham Thale So Dairy Cooperative Ltd. obtained its technical efficiency score of 0.992, 4) Thai-Danish Dairy Pak Chong Cooperative Ltd. obtained its technical efficiency score of 0.990, 5) Sikhio Dairy Cooperative Ltd. obtained its technical efficiency score of 0.980, 6) Chumpuang Dairy Cooperative Ltd. obtained its technical efficiency score of 0.969, 7) Khonburi Dairy Cooperative Ltd. obtained its technical efficiency score of 0.952, and 8) Thai-Danish Dairy Cooperative Ltd. obtained its technical efficiency score of 0.952

The main purpose of this study, it was to monitor the operational performance of dairy cooperatives Ltd. in the Nakhon Ratchasima province area when the time dimension changed. In another word, the 2years time-series data added which was the year of 2019 and 2020 (13 years) with 10 dairy cooperatives Ltd with the total number of 130 observations for calculating the Time Series Cross-Section (TSCS) model that followed the work of A.Wittayakorn-Puripunpinyoo, (2018, 2020) who conducted his research with 10 dairy cooperatives Ltd with 10 years of times series data with 100 observations he obtained. It was found that the technical efficiency score of 10 dairy cooperatives Ltd in Nakhon Ratchasima province did not change. The overall findings expressed that all of 10 dairy cooperatives Ltd. in Nakhon Ratchasima province kept the same shape of their technical efficiency score which were the high performance even the time dimension has been passed. This meant that all of the 10 dairy cooperatives in Nakhon Ratchasima province performed their own business with technical efficiency. The findings were answered 2 research questions of this research paper which were: 1) the dairy cooperatives Ltd. performed their own business with their technical efficiency, and 2) when the times' dimension changed with all factor inputs changed, the dairy cooperatives Ltd in Nakhon Ratchasima province area were still performed their business in the good shape 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, P., 2015). (Senphong. N., 2008). (Sinphan, S., 2016). (A.Wittayakorn-Puripunpinyoo, 2018, 2020)

Due to the research results, it expressed that all 10 dairy cooperative in Nakhon Ratchasima province performed their own business with their technical efficiency. Also, it expressed that the long trend of dairy cooperatives performance would be trended to be one of the good agricultural careers in Nakhon Ratchasima province of Thailand. Since dairy farming in Nakhon Ratchasima province seemed to be the stable career for farmers in terms of both income and employment source. Also, Nakhon Ratchasima province is one of the appropriate areas for dairy farming geographically. There is a tendency to increase the number of dairy farmers in Nakhon Ratchasima province. The research results also implied that business forms of cooperatives expressed the success of dairy cooperatives' performance appropriately. Also, the dairy cooperatives operations which are mostly operated by cooperatives members applying cooperatives value whose business operation perform based on the concepts of self-responsibility and help, the philosophy of democracy, the principles of equality, equity, and solidarity (International Co-operatives Alliance, 2021). This indicates that the production of raw milk by dairy cooperatives tends to increase to respond 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. N., 2008). (Suriya, P., 2015). (A.Wittayakorn-Puripunpinyoo, 2018, 2020). The research findings also gave some suggestions to the government agencies such as the department of cooperatives promotion, the department of agricultural extension to promote dairy farming in the Nakhon Ratchasima province area. Also, a financial institution such as the Bank for Agriculture and Agricultural Cooperatives (BAAC) as a credit provider to dairy farmers could have the information for farmers loan.

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



outcome from Dairy Cooperatives in Nakhon Ratchasima province of Thailand as the study area. It could conclude that all of the 10 dairy cooperatives performed their own business with technical efficiency. For further research suggestions, the research would be conducted in other areas where dairy cooperatives are located in such as Saraburi, Chaing Mai, and others to make the technical efficiency of dairy cooperatives performance. (Suriya, P., 2015), (Senphong, N., 2008), (Sinphan, S., 2016), (A.Wittayakorn-Puripunpinyoo, 2018, 2020). The results would be a benefit for the new dairy farmers and dairy cooperative to decide whether or not to perform their dairy farming.

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7. References

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