

Operational Efficiency of Credit Union Cooperatives in Surin Province

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Abstract

This study aims to examine the efficiency and factors influencing the operational efficiency of 32 credit union cooperatives in Surin Province. Secondary data were collected from related documents and reports provided by cooperative regulatory agencies. The Data Envelopment Analysis (DEA) model, under the assumption of Variable Returns to Scale (VRS), was applied to evaluate the operational efficiency. Additionally, factors influencing operational efficiency were analyzed using the Tobit Regression model. The findings indicate that credit union cooperatives in Surin Province exhibit high operational efficiency, with an average score of 0.8133. Regarding returns to scale, 53.13% operate at Constant Returns to Scale (CRS), 28.13% at Increasing Returns to Scale (IRS), and 18.75% at Decreasing Returns to Scale (DRS). Factors significantly influencing efficiency include management experience (Z_2), frequency of meetings (Z_3), debt ratio (Z_5), and loan value per member (Z_6). Credit union cooperatives should focus on enhancing management skills and experience through training and knowledge exchange activities. They should also increase the frequency of meetings with clear objectives to strengthen strategic decision-making and problem-solving capabilities. These measures will help enhance the cooperatives' operational efficiency sustainably, benefiting members in the long term.

Keywords: Operational Efficiency, Data Envelopment Analysis, Tobit Regression, Credit Union Cooperatives, Surin Province

Introduction

Poverty is a structural issue that profoundly impacts the economic and social development of Thailand, particularly in rural areas where the population has lower-than-average incomes and limited access to basic services such as education, healthcare, and employment opportunities. These challenges stem from disparities in resource allocation and infrastructure development, which tend to focus on urban areas. According to the Office of the National Economic and Social Development Council (2024), Thailand's poverty rate stands at 3.41%, representing approximately 2.39 million people. The northeastern region has the highest concentration of poverty, with approximately 758,000 people or 31.71% of the nation's impoverished population, mainly engaged in agriculture and residing in underdeveloped rural areas.

In the Thai rural context, poverty is not merely a lack of income or basic necessities but also a lack of opportunities and long-term self-reliance. To address these challenges, government agencies and relevant organizations have implemented various measures, including supporting financial institutions that play a crucial role in poverty alleviation and economic capacity building.

Credit union cooperatives are one such financial institution, established to combat poverty by strengthening financial resilience at the community level. They promote savings, provide loans for occupational development, and foster financial stability among members. Built on principles of equity and member participation, credit union cooperatives are pivotal in reducing poverty and improving rural quality of life. According to the Credit Union League of Thailand (2024), the country hosts 955 credit union cooperatives with over 1.04 million members and total assets exceeding 84.448 billion THB, underscoring their significant role as financial resources for rural communities.

Despite their importance, credit union cooperatives face operational challenges such as resource shortages, lack of transparent management, and unclear strategies.

Surin Province, known for its cultural richness and agricultural significance, grapples with economic and social challenges such as poverty and financial inequality. The majority of its population depends on agriculture with unstable incomes. Credit union cooperatives in Surin Province serve as an essential mechanism to help residents escape poverty and build financial stability. However, 20% of cooperatives in the province encounter asset management issues, and 15% struggle with risk management (Surin Provincial Cooperative Office, 2022). Furthermore, economic changes and the integration of digital technologies into financial systems exert additional pressures on cooperatives to adapt and maintain competitiveness. Without effective strategic development and management, these cooperatives face heightened risks of unsustainability.

Studying the factors influencing the operational efficiency of credit union cooperatives in Surin Province is therefore critical. Such research can reveal limitations and opportunities for cooperative development tailored to the local context. Previous studies, such as those by Leamvijarn (2018), highlight that governance, management, and member participation are key factors influencing cooperative success. Similarly, Walayasevi (2006) emphasized the role of financial institutions in creating economic opportunities to alleviate poverty.

Thus, examining the efficiency and factors affecting the operational performance of credit union cooperatives in Surin Province is essential to enhance their capacity and ensure they sustainably meet the needs of rural communities.

Literature Review

Data Envelopment Analysis (DEA) was developed by Charnes, Cooper, and Rhodes in 1978 to analyze the efficiency of Decision-Making Units (DMUs) in utilizing resources (inputs) to generate appropriate outputs. DEA is a non-parametric analysis method that does not require pre-determining the relationship between inputs and outputs, making it more flexible “*compared to traditional statistical methods like regression analysis. This method is suitable*” for organizations with diverse resources and outputs, such as hospitals, schools, or financial institutions.

DEA consists of two main models: the CCR Model and the BCC Model. The CCR Model, developed by Charnes et al. (1978), uses the Constant Returns to Scale (CRS) assumption to measure overall technical efficiency. Meanwhile, the BCC Model, developed by Banker et al. (1984), incorporates Variable Returns to Scale (VRS) to separate efficiency into two components: pure technical efficiency and scale efficiency.

The CCR Model, proposed by Charnes et al. (1978), is an Input-Oriented DEA Model under the Constant Returns to Scale (CRS) condition. The model can be expressed in equation form as follows (Charnes et al., 1987, as cited in Unthong, 2004).

$$\begin{aligned} & \text{Min } \sum_{i=1}^m \omega_i x_{ij0} \\ \text{Subject to } & \sum_{j=1}^n \mu_r y_{rj0} = 1, \quad \sum_{j=1}^n \mu_r y_{rj} - \sum_{i=1}^m \omega_i x_{ij} \leq 0 \\ & \mu_r, \omega_i \geq \varepsilon > 0; i=1, \dots, m, r=1, \dots, s, j=1, \dots, n \end{aligned} \quad (1)$$

Where:

- x_{ij} : The quantity of input i used by DMU j .
- y_{rj} : The quantity of output r produced by DMU j .
- μ_r : The weight of output r .
- ω_i : The weight of input i .
- n : The number of DMUs.
- m : The number of inputs.
- s : The number of outputs.
- ε : A small positive value.

The model in equation (1) represents the Multiplier Form of DEA analysis. For computational convenience in measuring production unit efficiency, the dual problem of equation (1) can be used to find mathematical solutions. The dual problem of the model can be written as follows:

$$\begin{aligned} & \text{Max } \theta + \varepsilon (\sum_{i=1}^m s_{ij0}^- + \sum_{r=1}^s s_{rj0}^+) \\ \text{Subject to } & \sum_{j=1}^n \lambda_j x_{ij} + s_{ij0}^- = x_{ij0}, \quad \sum_{j=1}^n \lambda_j y_{rj} - \theta y_{rj0} - s_{rj0}^+ = 0 \\ & \lambda_j, s_{ij0}^-, s_{rj0}^+ \geq 0; i=1, \dots, m, r=1, \dots, s, j=1, \dots, n \quad \theta \text{ (unconstrained)} \end{aligned} \quad (2)$$

When s_{ij0}^- represents the surplus input, and s_{rj0}^+ represents the shortfall in output, for the efficiency of a production unit located on the frontier or equal to 1, the target adjusted for inefficiency can be calculated as follows:

$$\begin{aligned} & x'_{ij0} = x_{ij0} - s_{ij0}^{*-} \text{ and } y'_{rj} = \theta^* y_{rj0} - s_{rj0}^{*+} \\ & \text{where the variables } g_0 = \theta^* = 1, s_{ij0}^{*-} = s_{rj0}^{*+} = 0 \end{aligned} \quad (3)$$

The Data Envelopment Analysis (DEA) model in the envelopment form is more flexible and less restrictive than the multiplicative form, making it more widely used. The variable θ serves as an index for measuring technical efficiency (TE), ranging from 0 to 1. If θ equals 1, it implies the production unit is fully efficient on the efficiency frontier.

This model is developed under the assumption of Constant Returns to Scale (CRS), which is suitable for cases where production units operate at the optimal scale. However, in scenarios with constraints, such as imperfect competition, Banker et al. (1984) introduced a model based on the assumption of Variable Returns to Scale (VRS). This model incorporates a convexity constraint to ensure the efficiency analysis is suitable for production units of similar sizes. Moreover, the VRS model supports analysis under Non-Increasing Returns to Scale (NIRS), allowing for broader and more adaptable efficiency evaluations. The formulation can be expressed as follows:

$$\begin{aligned}
 & \text{Min}_{\theta, \lambda} \theta \\
 \text{Subject to} \quad & -y_i + y\lambda \geq 0 \\
 & \theta x_i - x\lambda \geq 0 \\
 & N1' \lambda \leq 1 \\
 & \lambda \geq 0
 \end{aligned} \tag{4}$$

The application of Data Envelopment Analysis (DEA) to measure the efficiency of financial institutions, such as banks or credit unions, has gained widespread popularity due to its flexibility in analyzing the utilization of diverse inputs and outputs. For example, Jiang & He (2018) studied the efficiency of listed banks in China and found that most banks demonstrated strong efficiency trends, with some maintaining technical efficiency while others experienced a slight decline of less than 1.0%. Similarly, Huiqing (2019) analyzed changes in the efficiency of commercial banks in China, revealing significant improvements and reductions in efficiency during certain years.

In Thailand, Wareesri & Leamvijarn (2018) examined the efficiency of credit unions in the 12th provincial group. They found that very large, large, and medium-sized credit unions exhibited the highest efficiency levels. However, most faced issues related to decreasing returns to scale (DRS). In 2022, Fersi & Boujelbène analyzed the financial and social efficiency of small Islamic financial institutions, finding that their overall average efficiency scores were 50% lower than those of larger institutions. Meanwhile, Nittayakamolphon et al. (2022) studied the operational efficiency of Thai commercial banks in the digital era, reporting that efficiency in the financial intermediary role (0.905) was higher than in the business sector role (0.862), with statistically significant differences based on bank size.

A review of the literature highlights that DEA is a suitable tool for analyzing the technical efficiency of organizations utilizing diverse resources, such as hospitals, schools, or financial institutions, under the assumption of Variable Returns to Scale (VRS). Tobit regression is commonly employed to study the factors influencing efficiency. Therefore, this study uses DEA under the VRS assumption and Tobit regression to analyze the efficiency and factors affecting the performance of credit unions in Surin Province.

Research Methodology

Data and Variables

This study utilized secondary data on the operations of credit union cooperatives in Surin Province, collected from annual reports of individual cooperatives, financial statements, related documents, and reports from cooperative regulatory agencies, as well as statistical

data from the Surin Provincial Cooperative Office. The research focused on 32 credit union cooperatives in Surin Province, employing a purposive sampling method, with all cooperatives included as the sample group. These cooperatives were categorized into four groups based on their size according to the classification criteria of the Department of Cooperative Auditing, as shown in Table 1.

Table 1. Sample Groups of Credit Union Cooperatives in Surin Province

Cooperative Size	Number (Units)
Very Large	4
Large	12
Medium	14
Small	2
Total	32

Source: Credit Union League of Thailand (2024)

The variables used in the study are divided into three categories:

1. Input Variables:

- Operating expenses (X_1): Measured in THB/year.
- Member deposits (X_2): Measured in THB/year.
- Loans provided (X_3): Measured in THB/year.
- Number of members (X_4): Measured in persons.

2. Output Variables:

- Total revenue (Y_1): Measured in THB/year.
- Total assets (Y_2): Measured in THB/year.

3. Independent Variables:

- Manager Education Level (Z_1).
- Management experience (Z_2): Measured in years.
- Frequency of Meetings (Z_3): Measured in meetings/year.
- Length of Establishment (Z_4): Measured in years.
- Debt ratio (Z_5).
- Loan value per member (Z_6): Measured in THB/year.

Data Analysis

The data analysis was conducted in two parts:

- 1. Efficiency Assessment:** The Data Envelopment Analysis (DEA) model was used, based on the Variable Returns to Scale (VRS) assumption. This quantitative method evaluates the efficiency of organizations with diverse outputs and resources, enabling detailed insights into the operational efficiency of credit union cooperatives.
- 2. Analysis of Factors Influencing Efficiency:** The Tobit Regression Model was employed, suitable for analyzing efficiency scores that range between 0 and 1.

Results and Discussion

Operational Efficiency of Credit Union Cooperatives in Surin Province

The study of operational efficiency of credit union cooperatives in Surin Province revealed that 24 credit union cooperatives (75.00%) demonstrated the highest level of

operational efficiency. Three cooperatives (9.38%) showed high operational efficiency, another three cooperatives (9.38%) exhibited medium operational efficiency, and two cooperatives (6.25%) displayed low operational efficiency.

The average operational efficiency scores were 0.9933 for the highest efficiency group, 0.7350 for the high efficiency group, 0.4908 for the medium efficiency group, and 0.3169 for the low efficiency group. The overall average efficiency score of credit union cooperatives was at the highest efficiency level at 0.8133 (Table 2).

Table 2. Operational Efficiency Levels under the Variable Returns to Scale (VRS) Assumption

Efficiency Level	Divided by credit union size					Average VRS Efficiency
	Very Large	Large	Medium	Small	Total	
	Units (%)	Units (%)	Units (%)	Units (%)	Units (%)	
Very High (0.8001-1.0000)	2 (50.00)	12 (100.00)	9 (64.29)	1 (50.00)	24 (75.00)	0.9933
High (0.6001-0.8000)	0 (0.00)	0 (0.00)	3 (21.43)	0 (0.00)	3 (9.38)	0.7350
Medium (0.4001-0.6000)	2 (50.00)	0 (0.00)	1 (7.14)	0 (0.00)	3 (9.38)	0.4908
Low (0.2001-0.4000)	0 (0.00)	0 (0.00)	1 (7.14)	1 (50.00)	2 (6.25)	0.3169
Very Low (0.0000-0.2000)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0.0000
Total	4 (100.00)	12 (100.00)	14 (100.00)	2 (100.00)	32 (100.00)	0.8133

When considering returns to scale of credit union cooperatives under the VRS assumption, it was found that among credit union cooperatives in Surin Province, 17 cooperatives (53.13% of the total sample) exhibited Constant Returns to Scale (CRS), 9 cooperatives (28.13%) showed Increasing Returns to Scale (IRS), and 6 cooperatives (18.75%) demonstrated Decreasing Returns to Scale (DRS), as shown in Table 3.

Table 3. Returns to Scale of Credit Union Cooperatives under VRS Assumption

Efficiency Level	Return to scale			
	CRS	IRS	DRS	Total
	Units (%)	Units (%)	Units (%)	Units (%)
Very High (0.8001-1.0000)	14 (43.75)	6 (18.75)	4 (12.50)	24 (75.00)
High (0.6001-0.8000)	1 (3.13)	0 (0.00)	2 (6.25)	3 (9.38)
Medium (0.4001-0.6000)	0 (0.00)	3 (9.38)	0 (0.00)	3 (9.38)
Low (0.2001-0.4000)	2 (6.25)	0 (0.00)	0 (0.00)	2 (6.25)
Very Low (0.0000-0.2000)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Total	17 (53.13)	9 (28.13)	6 (18.75)	32 (100.00)

Factors Influencing Operational Efficiency

A Study of Factors Affecting the Operational Efficiency of Credit Union Cooperatives in Surin Province Using the Tobit Regression Model. The study found that management-related factors such as management experience (Z_2) positively correlated with operational efficiency, with a coefficient of 0.0892 and statistical significance at the 0.05 level. This suggests that managers with more experience are better equipped to manage operations effectively, particularly in risk management and strategic decision-making (Boyce et al., 2023). Additionally, the frequency of meetings (Z_3) showed a statistically significant positive correlation at the 0.05 level, with a coefficient of 0.5061. This reflects that frequent meetings enhance decision-making efficiency, improve internal organizational management, and facilitate timely follow-up and problem resolution (Mlay et al., 2023).

Financial factors include the debt ratio (Z_5), which demonstrated a statistically significant negative impact on operational efficiency at the 0.01 level, with a coefficient of -1.8927. This indicates that higher debt burdens negatively affect operational efficiency, likely due to increased financial costs and risks associated with higher debt levels or prolonged debt repayment periods (Kumar & Sharma, 2023). Conversely, the loan-to-member value (Z_6) was positively associated with operational efficiency, with a coefficient of 0.4195 and statistical significance at the 0.10 level. This suggests that providing loans at an appropriate level can enhance the operational efficiency of credit unions. However, this finding contradicts Haneef & Petchsakulwong (2018), who argued that high loan values per member could lead to inefficiencies due to difficulties in managing delinquent loans.

Factors that did not show statistically significant relationships with the operational efficiency of credit union cooperatives in Surin Province include the education level of managers (Z_1), which, despite a positive coefficient (0.3899), contradicts the findings of Zaidi et al. (2021), who reported that education level significantly influences operational performance. Similarly, the length of establishment (Z_4) had a negative coefficient (-0.2213), which contrasts with Simamora et al. (2023), who found a positive relationship between cooperative age and income-generating capability, attributing it to the credibility built over longer periods of operation (Table 4).

Table 4: Tobit Regression Results

Variable	Coefficient	S.E.	Z-Statistic	Significance
Coefficient	-0.3582	0.0938	-3.8187	***
Manager Education Level (Z_1)	0.3899	0.2030	1.9207	ns
Management Experience (Z_2)	0.0892	0.2610	0.3418	**
Frequency of Meetings (Z_3)	0.5061	0.2449	2.0666	**
Length of Establishment (Z_4)	-0.2213	0.5089	-0.4349	ns
Debt Ratio (Z_5)	-1.8927	0.5021	-3.7696	***
Loan value per member (Z_6)	0.4195	0.1509	2.7800	*
Log-likelihood		-45.2332		
S.D. dependent var		0.4031		
S.E. of regression		0.3172		

*, **, and *** = 10%, 5% and 1% level of significance respectively

Conclusions

The study of operational efficiency of Credit Union Cooperatives in Surin Province using the DEA method revealed that these credit unions demonstrated a very high level of operational efficiency, with an average efficiency score of 0.8133. Regarding returns to scale, the findings indicated that 17 credit unions (53.13%) operated under constant returns to scale (CRS).

In contrast, 9 credit unions (28.13%) exhibited increasing returns to scale (IRS), and 6 credit unions (18.75%) experienced decreasing returns to scale (DRS).

The analysis of factors affecting the operational efficiency of credit unions in Surin Province using the Tobit model identified four significant factors. Two were management-related factors: management experience (Z_2) and frequency of meetings (Z_3), both of which had statistically significant positive impacts at the 0.05 level. The other two were financial factors: the debt ratio (Z_5), which had a statistically significant negative impact at the 0.01 level, and the loan value per member (Z_6), which had a statistically significant positive impact at the 0.10 level. Conversely, manager education level (Z_1) and length of establishment (Z_4) did not show statistically significant relationships with operational efficiency.

Recommendations

Credit Union Cooperatives should enhance the skills and experience of their management teams by organizing training programs and knowledge-sharing activities focusing on management, risk, and strategic decision-making. This will improve their capacity to manage operations effectively. Additionally, credit unions should conduct meetings with an appropriate frequency, set clear goals, and follow up on action items post-meeting to ensure timely problem resolution and decision-making.

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