November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

Examining the Efficiency of Co-operatives in Malaysia: An Application of DEA

Fatin Syazwani Safiyuddin
Norazlina Abd Wahab
Selamah Maamor
Islamic Business School, UUM

Article Info
Volume 81
Page Number: 3989 - 4000
Publication Issue:
November-December 2019

Abstract:
The study examines the technical efficiency, pure technical efficiency, and scale efficiency of co-operatives in Malaysia. Data of co-operatives listed in 100 best Malaysian co-operatives from 2010 to 2017 was analyzed. To construct the efficiency model for the co-operatives, this study employed Data Envelopment Analysis (DEA). In DEA, one input (total assets) and two outputs (net income and dividend) were utilized. The results indicate that Malaysian co-operatives exhibited 62.3% overall technical efficiency during the study period where scale efficiency dominated the overall technical efficiency. Hence, we can suggest that Malaysian co-operatives had been performing better because of the scale of its operation instead of good managerial performance. The result also shows that most co-operatives were operating at non-CRS so that co-operatives need to make improvement in order to recover overall efficiency if pure technical inefficiency lead to the pure technical inefficient co-operatives could be undertaken. The result also demonstrates that scale efficiency (SE) dominated pure technical efficiency (PTE), which means that the scale and size of co-operatives are significant in raising the level of scale efficiency. The management of co-operatives in Malaysia should enhance their managerial performance because the PTE was found to contribute less to overall technical efficiency (OTE).

Keywords: *co-operatives, data envelopment analysis, pure technical efficiency, scale efficiency, technical efficiency*

Article History
Article Received: *5 March 2019*
Revised: *18 May 2019*
Accepted: *24 September 2019*
Publication: *19 December 2019*

1. Introduction

Cooperatives as an organization formed voluntarily by members in order to fulfill the economic needs and interests of the members. Through co-operatives, individuals could also get micro-credit facilities. Co-operatives are set up primarily to help members increase their income and subsequently the nation's total income. They also help create jobs, offer financial services to people, stimulate the growth of business, and promote community growth (Deller, Hoyt, Hueth, & Sundaram-stukel, 2009; Anania & Gikuri, 2015). In short, the philosophy of a co-operative establishment is not to maximize profit but to provide the best possible products and services to its members. To do so, a co-operative must be efficient.

According to the statistics released by the Department of Statistics Malaysia, in the first quarter of 2019, the Malaysian economy recorded RM341.7 billion of the total Gross Domestic Product (GDP). The economic development in Malaysia is contributed by a wide range of activities carried out by various entrepreneurial organizations, such as co-operatives, small and medium enterprises (SMEs), franchise chains, and social enterprises, including online businesses (Ministry of Entrepreneur Development, 2019). In particular, the co-operative sector recorded growth in turnover of 0.9% to RM40 billion in 2017, and the turnover is expected to increase to RM50 billion by 2020 (The Star Online, 15th March 2018). The significance of co-operatives in the country is indisputable; they will considerably contribute to the accomplishment of the

November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

Malaysian National Entrepreneurship Policy 2030 launched on 11thJuly 2019. This policy provides a framework or holistic ecosystem for entrepreneurship development in Malaysia. The co-operatives play an important role in realizing this policy because, through their activities, competitive entrepreneurs could be developed. Because of major role the co-operatives play in the Malaysian economy and GDP, their efficiency should be evaluated.

Efficiency has been defined variably. Farrell (1957) defines efficiency as the good usage of resources to make the most of the production of goods and services. To him, efficiency concerns the relationship between the inputs or resources and the outputs produced by using the inputs. According to Kumbhakar & Lovell (2000), efficiency is the use of resources to maximize the production of goods and services. Kipesha (2013) defines efficiency as how well organizations use their resources to produce goods and services, and the proportion at which the input resources are used to produce or deliver the outputs. Hence, we can refer to efficiency as to how well a firm utilizes the resources to avoid wastage so that the production of output is maximized while the use of resources is minimized.

Despite the fast-growing trend of different variants of local co-operatives, especially in Malaysia, co-operative efficiency is an unresolved issue. Firstly, co-operative directors are claimed to have a lack of skills and expertise. Many co-operatives in Malaysia are still being managed by people sitting on the board who serve voluntarily basis and not by full-time professional managers in bigger and more successful co-operatives (Othman & Kari, 2008). In addition, the selection of the board of directors in a general meeting tends to be made based on popularity rather than expertise (Othman, Mohamad & Abdullah, 2013). As a result, co-operatives have difficulties in maintaining good governance, raising inefficiency problems in administrative and financial management (Othman & Kari, 2008). As stated by the Deputy Minister of Entrepreneur Development, Dr Mohd Hatta Md Ramli, co-operatives are also weak in management and give low dividends, resulting in a reduced number of members (Utusan Online, 30thAugust 2018).

Insufficient capital is a big challenge in credit co-operatives. Most credit co-operatives in Malaysia have insufficient capital and cannot provide significant funding to members (Malaysian Co-operative Commission, 2011). The National Co-operative Policy (NCP, 2002-2010) acknowledges that co-operatives have a small amount of capital, and they depend on conventional sources of capital, such as membership fees, shared capital, and accumulated profits to operate (Othman et al., 2013). As a result, small-and medium-sized credit co-operatives tend to be less competitive. According to the Ministry of Domestic Trade, Co-operatives and Consumerism, Datuk Seri Hamzah Zainuddin, 596 credit co-operatives in Malaysia are encouraged to merge to strengthen their assets, loans and increase their capabilities in offering a wide range of products and services (Malaysian Co-operatives Commission, 2017)

This paper is the first attempt to discover the efficiency of co-operatives in Malaysia. The structure of this paper is as follows. The following section provides the background of Malaysian co-operatives and the literature on co-operatives and efficiency. While Section 3 explains the methodology and input-output specification, Section 4 reports the results. Finally, the last section offers some recommendations.

2. Literature Review

Efficiency indicates how well organizations use their inputs to produce the outputs (Farrell, 1957). Three types of efficiency measures such as technical efficiency, scale efficiency and price or allocative efficiency. A firm considered technically efficient when it produces relatively larger output from the same set of inputs, and price efficient when the firm maximise the profit (Hassan, 2006).

Previous studies on efficiency have considered various contexts, such as banking (Alrafadi, Kamaruddin, & Yusuf, 2014; Sassi, 2013; Said,

November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

2013; Yudistira, 2004), microfinance institutions (Kim, Long, & Sang, 2018; Lensink, Meesters& Hermes, 2011), pawnbroking (Maamor& Ismail, 2010) and zakat institutions (Noor, Rasool, Ali & Rahman, 2015; Wahab & Rahman, 2013). However, very few studies were carried out on co-operatives (e.g., Fukuyama, Guerra, & Weber, 1999; Xiong, Tian, & Ruan, 2011; Asawaruangpipop & Suwunnamek, 2014; Magali &Lang'at, 2014; Marwa & Aziakpono, 2014; Galarza, Campoverde & Borenstein, 2019). As a result, a study on co-operatives is warranted.

Fukuyama et al. (1999) in their study on the efficiency of credit co-operatives in Japan utilized Data Envelopment Analysis (DEA) where labor, capital, and deposits were regarded as inputs while loans and security investment as outputs. The study found that pure technical inefficiency dominated scale inefficiency. Because of input allocative inefficiency in the vast majority of credit co-operatives, they recommended that managers reallocate inputs and produce either more output at the same cost or the same output at lower cost.

Asawaruangpipop and Suwunnamek (2014) evaluated the efficiency of 732 savings and credit co-operatives in Thailand. The study utilized Data Envelopment Analysis (DEA) with total assets and operating expenses as inputs while interest and fee income, gross loan portfolio, and deposits as outputs. The study found that, according to the types of co-operatives, state enterprise co-operatives had a maximum quantity of efficient co-operatives and average efficiency score. Galarza et al. (2019) assessed 18 savings and credit co-operatives from 2007 to 2016. The study used Data Envelopment Analysis (DEA) where operation costs and uncollectable funds were regarded as inputs while total deposits, available funds, and service revenues as outputs. They observed that the key causes of inefficiency were the high level of operating costs and the loss of money in uncollectable funds. Xiong et al. (2011) also used Data Envelopment Analysis to study the efficiency of peasant household credit investigation system in rural credit co-operatives. The study found that during the period of the study, on average, scale efficiency in both regions was higher than pure technology efficiency. The study also showed that the efficiency of resource allocation in both regions decreased. General efficiency was also somewhat low and was declining.

On the other hand, Magali and Lang'at (2014) utilized descriptive and qualitative analysis to examine the efficiency of the best rural savings and credit co-operatives (SACCOS) in Morogoro, Dodoma, and Kilimanjaro regions in Tanzania. The study revealed that savings and credit co-operatives societies (SACCOS) in Morogoro outperformed those in the Dodoma and Kilimanjaro because the adequate experience was responsible for directing the SACCOS business. Furthermore, the co-operatives in Morogoro were dedicated to loan screening, processing and recovery, adhered to good leadership, had loyal staff, and the management had appropriate credit risk mitigation techniques.

Based on previous studies, this efficiency study has been widely conducted in financial institutions. However, it is still lacking in the cooperative sector especially in Malaysia even though this sector also contributes to the country's GDP. As stated by Deputy Minister of Entrepreneur Development, Datuk Dr Mohd Hatta Md Ramli, the Malaysian Cooperative Commission can be as the third contributor to the national economy after the government and private sectors because it has assets of more than RM140 billion (Astroawani, 30th October 2018).

The history of co-operatives in Malaysia began in 1913 with the establishment of *Syarikat Perniagaan dan Pertukangan Melayu.* The Federated Malay States Posts and Telegraphs Co-operatives Thrift and Loan Society Limited (*Syarikat Kerjasama Jimat Cermat dan Pinjaman Wang Pekerja-pekerja Jabatan Pos dan Telekom Berhad*) became the first co-operative to be formally registered on 21st July 1922 aimed at helping villagers to get financing without high

November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

interest. It shows that from the very beginning, the establishment of the cooperatives is expected to improve the economy of its members.

Currently, there are nine types of co-operatives operating in Malaysia to serve various groups. There are co-operative banks, credit co-operatives, agricultural co-operatives, housing co-operatives, industrial co-operatives, consumer co-operatives, construction co-operatives, transportation co-operatives, and service co-operatives. These co-operatives are managed by the Malaysian Co-operative Commission. The total number of co-operatives in Malaysia is 13,247 with 7,025,127 registered members (Malaysian Co-operative Commission, 2016). Because of the big size of the membership, each co-operativeis responsible for making sure that they operate efficiently to benefit their members.

To date and to the best of our knowledge, efficiency studies on co-operatives outside Malaysia had used the DEA method. Although other methods to examine efficiency are available, such as Frontier Approaches, which consist of Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA), and Thick Frontier Approach (TFA), DEA is a popular method to evaluate the financial institutions including banks, microfinance institutions and cooperatives because it easily handles multiple outputs, is non-parametric, and does not require input prices. Hence, we employed DEA to examine the efficiency of co-operatives in Malaysia.

3. Research Methodology

This study is about the technical efficiency of co-operatives in Malaysia. We used unpublished data of 100 best co-operatives from the Malaysian Co-operative Commission database. The period of the study was from 2010 to 2017. Since each year a co-operative goes out of the list of the 100 best co-operatives, we took into account the co-operatives that appeared in all consecutive years only. Hence, only 16 co-operatives were evaluated. To construct an efficiency model of the co-operatives, this study utilized the Data Envelopment Analysis (DEA). In DEA, one input (total assets) and two outputs (net income and dividend) were considered.

Farrell (1957) first introduced the Data Envelopment Analysis (DEA), which was later extended by Charnes, Cooper, and Rhodes (1978). A few studies have utilized DEA to evaluate the efficiency of the banking industry, such as Mokhtar, Abdullah & Al-Habshi (2006**)** and Sufian, Kamarudin & Noor (2012). Park and De (2004) revealed that DEA is an important approach to measure efficiency. The method can be applied to studying co-operatives because co-operatives are considered financial institutions, and the nature of business is similar to that of banks because both offer financial services.

The standard valuation of efficiency can be distributed into two models. They are Charnes-Cooper-Rhodes Model (CCR model) and the Banker-Charnes-Cooper Model (BCC model). Coelli, Rao, and Battese (1998) state that both models permit technical efficiency (TE) to be decomposed into two mutually comprehensive components, which are pure technical efficiency (PTE) and scale efficiency (SE). The dissimilarity between the two models is the treatment of return-to-scale. BCC permits variable return-to-scale (VRS), whereas CCR assumes that each cooperative (C) operates with constant return-to-scale (CRS). Maamor (2010) notes that PTE represents a manager's capability to use a firm's given resources while SE denotes the exploitation of scale economies that operate at a point where the production frontier exhibits constant return-to-scale. Meanwhile, TE examines the proportional reduction in input usage that can be attained if C operates on the efficient frontier while it is PTE if inputs are not wasted and SE if C achieves CRS. Luo (2003) states that SE can be utilized to determine how close C operates to the most productive scale size.

A measure of efficiency for each decision-making unit (DMU) as introduced by Charnes, Cooper, and Rhodes to obtain a maximum ratio of weighted output to weighted input. The weight of the ratio is determined by a limitation in which a similar ratio for every DMU has to be less than or

November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

equal to unity. In consequence, it will drop multiple inputs and outputs to a single virtual input and single virtual output without needing pre-assigned weights. Hence, the efficiency measure is a function of the weights of the virtual input-output combination.

The BCC model is consequential from the DEA model. By solving the model for each DMU, the BCC efficiency scores are attained with a similar interpretation of the values as in the CCR model. These scores are also called "pure technical efficiency score" since they are attained from a model that permits variable returns-to-scale and hence eradicates the "scale part" from the analysis.

The scale efficiency score is defined by the ratio of CCR/BCC or (TE/PTE). At that point, a DMU_o, is found to be efficient with a CCR model which is also found to be efficient for the corresponding BCC model, and a constant return-to-scale means that DMU_o is the most productive scale size. When a DMU_O shows decreasing returns-to-scale,

$$\left(\sum_{j=1}^{n} \lambda_j > 1\right)$$

it is likely that the DMU_o can develop its performance by decreasing its size. On the other hand, when a DMU_O shows increasing return-to-scale,

$$\left(\sum_{j=1}^{n} \lambda_j < 1\right)$$

it is likely that a DMU_o can improve its performance by increasing its size.

4. Input and Output Specification

The choice of inputs and outputs in this study was essentially determined by data availability. As indicated earlier, 16 co-operatives were found to be listed in the 100 best co-operatives consecutively for the period of 2010 to 2017. The list of 16 co-operatives used in this study is shown in Appendix 1. One input and two outputs were considered to examine the efficiency of 16 co-operatives in Malaysia. The input was total assets while the outputs were net income and dividend.

This study utilized output-oriented DEA where a linear program was constructed to determine a co-operative's potential output given its inputs if it worked efficiently as a co-operative along the best practice frontier. The output-oriented was used by considering the case where the co-operative may have a fixed amount of resources and enquired to produce as much output as possible (Coelli, Rao &Battese, 1998).

This study employed the production approach. The production approach assumes that co-operatives act as producers in collecting savings, offering other financial services, and providing returns in the form of dividends if the co-operatives gain profits. In this study, the inputs were adopted from the model developed by Asawaruangpipop and Suwunnamek (2014), who analyzed the efficiency of savings and credit co-operatives while the outputs were developed based on the objective that was to analyze the efficiency of a co-operative in producing net income and dividend to its members.

Table 4.1 Descriptive statistics of the inputs and outputs employed in this study (RM million)

	Mean	Maximum	Minimum	Standard Deviation
Input				
2010				
Total Assets (x1)	3,567,522.90	50,637,603.00	3,710.01	12,569,787.76
2011				
Total Assets (x1)	4,324,099.00	61,912,061.00	4,065.81	15,374,871.32
2012				
Total Assets (x1)	5,033,670.81	72,478,918.00	4,690.11	18,005,537.16
2013				
Total Assets (x1)	5,514,044.29	79,208,627.00	4,950.06	19,675,250.54

November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

2014				
Total Assets (x1)	5,916,429.00	82,879,599.00	5,566.52	20,575,151.83
2015				
Total Assets (x1)	6,312,468.38	89,176,654.65	5,575.65	22,138,692.63
2016				
Total Assets (x1)	6,962,461.11	99,011,594.00	6,058.04	24,584,180.89
2017				
Total Assets (x1)	7,432,104.46	105,148,000.00	6,472.53	26,095,775.98
Output				
2010				
Net Income (y1)	134,663.32	1,550,002.00	330.47	386,557.47
Dividend (y2)	45,806.11	398,000.00	93.95	101,865.06
2011				
Net Income (y1)	147,482.83	1,717,133.00	536.93	426,882.18
Dividend (y2)	47,882.66	398,000.00	63.01	102,047.21
2012				
Net Income (y1)	177,415.49	2,018,992.00	346.50	503,832.75
Dividend (y2)	52,872.72	428,473.00	119.04	112,160.73
2013				
Net Income (y1)	186,513.36	2,113,883.00	568.58	527,386.82
Dividend (y2)	59,439.65	495,058.00	144.35	128,859.53
2014				
Net Income (y1)	284,875.39	2,125,418.00	425.10	713,394.59
Dividend (y2)	58,617.17	441,053.00	179.89	120,687.13
2015				
Net Income (y1)	175,221.86	2,160,185.28	305.47	534,931.30
Dividend (y2)	60,055.48	443,502.00	157.56	124,559.71
2016				
Net Income (y1)	110,563.14	1,126,167.00	68.35	281,679.48
Dividend (y2)	53,391.49	384,822.00	50.93	111,444.40
2017				
Net Income (y1)	130,062.23	1,319,394.00	35.09	329,902.04
Dividend (y2)	56,645.70	443,774.00	.00	122,097.72

Table 4.1 reports the descriptive statistics of the outputs and inputs of 16 co-operatives in Malaysia during the study period. On average, there was a wide range between the minimum and maximum amount of inputs used and outputs produced by Malaysian co-operatives. This situation could happen due to internal and external reasons. For instance, the wide range between the minimum and maximum amount of dividend in 2017 could be due to an internal reason where the board of directors of Koperasi Felda Sebertak Pahang Berhad decided not to give out any dividend, board member's honorarium, and any distribution of fund in that particular year (Annual Report Koperasi Felda Sebertak Pahang Berhad, 2017).

5. Result and Discussion

This section presents the efficiency score of co-operatives from the year 2010 until 2017. All data were measured by DEA to identify the level of efficiency of each co-operative. The result is output-oriented by considering the case where production involved two outputs and one input (Coelli et al., 1998). In this study, net income and dividend were the outputs, whereas total assets the inputs. The value of overall technical efficiency (OTE) of 16 co-operatives in Malaysia is shown in Table 5.1.

Table 5.1: Overall technical efficiency of co-operatives in Malaysia (2010 to 2017)

November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

CO-OPERATIVES	2010	2011	2012	2013	2014	2015	2016	2017
Banking Co-operative 1	0.199	0.206	0.195	0.207	0.086	0.194	0.099	0.112
Banking Co-operative 2	0.553	0.365	0.281	0.267	0.176	0.197	0.153	0.143
Service Co-operative 1	1.000	1.000	1.000	1.000	1.000	0.632	1.000	1.000
Service Co-operative 2	0.315	0.684	0.305	0.280	0.195	0.310	0.169	0.188
Credit Co-operative 1	0.538	0.573	0.697	0.816	0.418	0.554	0.860	1.000
Credit Co-operative 2	0.628	0.672	0.538	0.584	0.419	0.585	0.731	0.491
Credit Co-operative 3	0.605	0.641	0.451	0.424	0.354	0.558	0.700	0.816
Credit Co-operative 4	0.702	0.639	0.568	0.635	0.487	0.606	0.920	0.990
Credit Co-operative 5	1.000	0.872	0.696	0.748	0.552	0.624	0.077	0.139
Credit Co-operative 6	0.722	0.603	0.473	0.523	0.408	0.537	0.886	0.909
Credit Co-operative 7	0.380	0.364	0.267	0.318	0.318	0.230	0.119	0.226
Credit Co-operative 8	0.458	0.315	0.292	0.360	0.305	0.393	0.807	0.718
Credit Co-operative 9	0.774	0.694	0.571	0.658	0.496	0.614	0.431	0.456
Housing Co-operative	0.592	0.766	0.711	1.000	0.325	1.000	1.000	1.000
Agriculture Co-operative	0.924	1.000	1.000	1.000	1.000	1.000	1.000	0.615
Transportation Co-operative	0.579	0.982	0.517	0.891	0.382	0.505	0.160	0.034

Table 5.1 shows that the highest efficiency score wasin 2013, 2016, and 2017 in which three co-operatives were efficient. Service Co-operative 1was found to be efficient in all years under study except in 2015. Interestingly, Agriculture Co-operative was efficient insix consecutive years from 2011 to 2016.

Table 5.2: Pure technical efficiency of co-operatives in Malaysia (2010 to 2017)

CO-OPERATIVES	2010	2011	2012	2013	2014	2015	2016	2017
Banking Co-operative 1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Banking Co-operative 2	0.561	0.386	0.333	0.305	0.275	0.286	0.168	0.143
Service Co-operative 1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Service Co-operative 2	0.319	0.697	0.310	0.283	0.199	0.312	0.170	0.190
Credit Co-operative 1	0.544	0.610	0.738	0.816	0.795	0.933	1.000	1.000
Credit Co-operative 2	0.633	0.678	0.543	0.586	0.422	0.586	0.741	0.498
Credit Co-operative 3	0.634	0.664	0.480	0.434	0.378	0.585	0.767	0.913
Credit Co-operative 4	0.709	0.647	0.577	0.639	0.494	0.609	0.933	1.000
Credit Co-operative 5	1.000	0.876	0.700	0.750	0.554	0.625	0.078	0.143
Credit Co-operative 6	0.727	0.608	0.480	0.526	0.414	0.541	0.907	0.932
Credit Co-operative 7	0.396	0.375	0.279	0.325	0.336	0.240	0.130	0.249
Credit Co-operative 8	0.462	0.317	0.293	0.362	0.306	0.398	0.813	0.723
Credit Co-operative 9	0.790	0.707	0.586	0.667	0.512	0.628	0.449	0.477
Housing Co-operative	0.597	0.766	0.720	1.000	0.331	1.000	1.000	1.000
Agriculture Co-operative	0.936	1.000	1.000	1.000	1.000	1.000	1.000	0.617
Transportation Co-operative	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

According to Table 5.2, during the period of the study (2010 to 2017), PTE showed that Banking Co-operative 1, Service Co-operative 1,and Transportation Co-operative were efficient, implying that the managerial efficiency of these co-operatives was good during that period. Agriculture Co-operative was efficient in six consecutive years (2011 to 2016). Remarkably, six co-operatives were efficient in 2016 and 2017.

Table 5.3: Scale efficiency of co-operatives in Malaysia (2010 to 2017)

CO-OPERATIVES	2010	2011	2012	2013	2014	2015	2016	2017
Banking Co-operative 1	0.199	0.206	0.195	0.207	0.086	0.194	0.099	0.112
Banking Co-operative 2	0.985	0.946	0.843	0.876	0.639	0.687	0.914	1.000

November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

Service Co-operative 1	1.000	1.000	1.000	1.000	1.000	0.632	1.000	1.000
Service Co-operative 2	0.988	0.982	0.983	0.993	0.983	0.992	0.995	0.989
Credit Co-operative 1	0.990	0.939	0.944	0.999	0.526	0.594	0.860	1.000
Credit Co-operative 2	0.991	0.991	0.990	0.996	0.993	0.999	0.986	0.985
Credit Co-operative 3	0.954	0.966	0.939	0.976	0.938	0.954	0.912	0.893
Credit Co-operative 4	0.990	0.988	0.984	0.993	0.986	0.995	0.987	0.990
Credit Co-operative 5	1.000	0.996	0.994	0.997	0.995	0.998	0.990	0.978
Credit Co-operative 6	0.994	0.991	0.985	0.994	0.987	0.993	0.977	0.976
Credit Co-operative 7	0.962	0.970	0.956	0.979	0.948	0.960	0.917	0.908
Credit Co-operative 8	0.990	0.993	0.994	0.997	0.996	0.986	0.992	0.992
Credit Co-operative 9	0.980	0.982	0.975	0.987	0.968	0.977	0.959	0.956
Housing Co-operative	0.991	1.000	0.988	1.000	0.983	1.000	1.000	1.000
Agriculture Co-operative	0.987	1.000	1.000	1.000	1.000	1.000	1.000	0.998
Transportation Co-operative	0.579	0.982	0.517	0.891	0.382	0.505	0.160	0.034

Source: Research data

Table 5.3 shows that Service Co-operative 1 was efficient during the period of the study except in 2015. This could be due to a large number of members each year it had compared to other co-operatives (Malaysian Co-operative Commission, 2015). A huge membership size requires that the co-operative maintains or increases the number of its members consistently to enhance its scale efficiency. Agriculture Co-operative was efficient from 2011 to 2016. Agriculture Co-operative could maintain scale efficiency because applicants had to pay a membership fee and purchase farm units to qualify them to be co-operatives' members. Therefore, such a condition could have helped the co-operatives increase their shared capital.

The mean values of OTE, PTE, and SE of co-operatives in Malaysia in 2010 to 2017 are depicted in Table 5.4.

Table 5.4: Average of OTE, PTE and SE in 2010 to 2017 of 16 selected co-operatives

	OTE	**PTE**	**SE**
2010	0.623	0.707	0.911
2011	0.649	0.708	0.933
2012	0.535	0.627	0.893
2013	0.607	0.668	0.930
2014	0.433	0.564	0.838
2015	0.534	0.671	0.842
2016	0.570	0.697	0.859
2017	0.552	0.680	0.863
MEAN	0.623	0.707	0.911

According to Table 5.4, co-operatives in Malaysia exhibited 62.3%, 70.7%, and 91.1% of OTE, PTE, and SE, respectively, during the study period. The result also shows that the highest OTE, PTE, and SE were in 2011. This result could be attributed to the National Co-operative Policy 2011-2020 which aims to enhance the economic development activity of co-operatives and the good governance of co-operatives, increase public confidence, and most importantly, increase the Gross Domestic Product (GDP). Hence, the implementation of this policy might have affected the OTE, PTE, and SE in 2011. According to the economic development report released by Bank Negara Malaysia, the Malaysian economy had stable growth of 5.1% in 2011 due to stronger domestic demand driven by household and business spending. Civil servants also benefitted from two half-month bonus payments in the second half of the year while households in rural areas benefitted from higher prices of rubber and palm oil (Bank Negara Malaysia, 2011). Therefore, the economic circumstances in 2011

might have been responsible for increasing the co-operatives' income.

On the other hand, in 2014, the level of efficiency was lower than that in other years, which could be due to the low income of the co-operatives. Koperasi Angkatan Tentera Malaysia, Kopetro, and Koperasi Co-op Bank Persatuan Malaysia Berhad saw a decline in their net income in 2014 compared to that in 2013 and 2015. For example, the income of Bank Kerjasama Rakyat Malaysia was RM5.98billion in 2014 compared to RM6.07billion in 2013 (Bank Kerjasama Rakyat Annual Report, 2014). Koperasi Angkatan Tentera Malaysia Berhad (KATMB) also saw a decline in net income and dividend distribution in 2014 (KATMB Annual Report, 2014). The decline in 2014 might be due to the growth performance affected by new risks and continuous adjustments to the external shock, including low commodity prices, slower growth in advanced economies, and regional, and geopolitical developments (Bank Negara Malaysia, 2016).

Overall, during the period of the study (2010 to 2017), the results indicate that scale efficiency dominated the overall technical efficiency, suggesting that Malaysian co-operatives had been performing better because of the scale of its operation instead of good managerial performance. Hence, it is suggested that co-operatives need to maintain a good scale in terms of membership fees and shared capital to enhance scale efficiency. The results of overall technical efficiency (OTE), pure technical efficiency (PTE), and scale efficiency (SE) are illustrated in Figure 5.1.

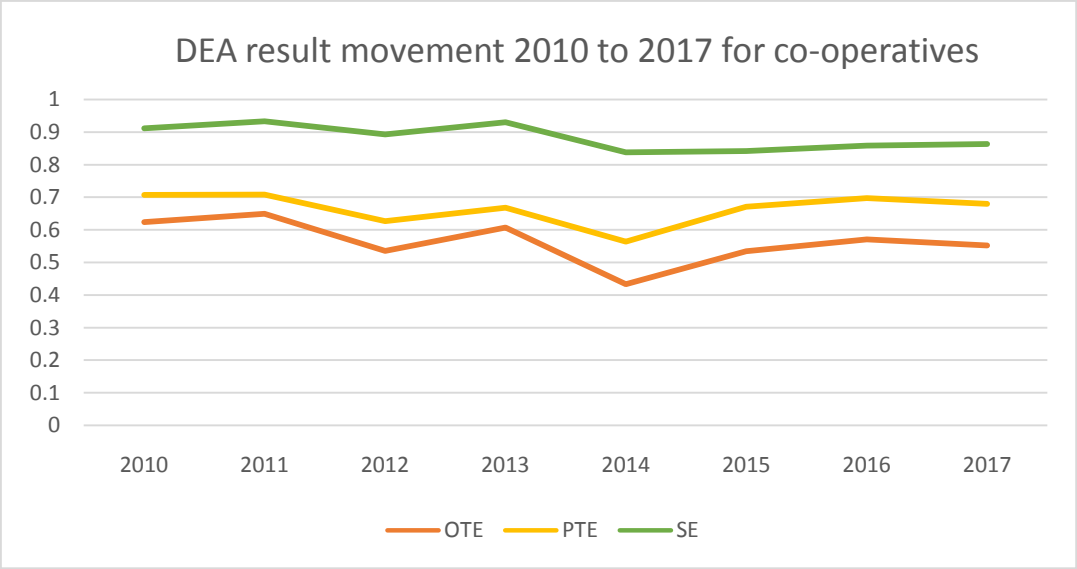

Figure 5.1: DEA result movementfor co-operatives (2010 to 2017)

Figure 5.1 shows the efficiency of co-operatives in Malaysia. In terms of OTE, it rose in 2010 and 2011, declined in 2012, and increased again in 2013. The OTE gradually declined in 2014 and increased again from 2015 to 2017. In terms of PTE, it slightly increased in 2010 and 2011, declined in 2012, increased again in 2013, declined in 2014, and increased from 2015 to 2017. The finding shows the fluctuation of SE in 2010 and 2013, declined in 2014 and increased again from 2015 to 2017. The decline in 2014 could be due to the low growth performance of GDP affected by new risks and continuous adjustments to the external shock, including low commodity prices, slower growth in advanced economies, and regional, and geopolitical developments (Bank Negara Malaysia, 2016).

We now turn our discussion to the developments of the returns to scale of co-operatives in Malaysia. Constant return to scale (CRS) means that an increase in inputs results in a proportionate increase in outputs. Decreasing return to scale

November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

(DRS) reflects an increase in inputs that results in a lesser output increase. Increasing return to scale (IRS) indicates that an increase in inputs results in a higher increase in outputs.

Table 5.5 displays the results of the developments in returns to scale of co-operatives in Malaysia. We can see the constant return to scale (CRS), increasing return to scale (IRS), and decreasing return to scale (DRS) of Malaysian co-operatives. Table 5.5 indicates that the majority of the Malaysian co-operatives were operating at IRS. This result suggests that the output increased by a larger proportion than the increase in inputs during the production process. Hence, Malaysian co-operatives need to increase their inputs in order to produce more outputs.

Table 5.5: Returns to scale in co-operatives in Malaysia

	2010		2011		2012		2013		2014		2015		2016		2017	
	No of coop	%	No of coop	%	No of coop	%	No of coop	%	No of coop	%	No of coop	%	No of coop	%	No of coop	%
CRS	2	12.5	3	18.75	2	12.5	4	25	2	12.5	2	12.5	3	18.75	4	25
DRS	4	25	3	18.75	3	18.75	2	12.5	3	18.75	5	31.25	3	18.75	1	6.25
IRS	10	62.5	10	62.5	11	68.75	10	62.5	11	68.75	9	56.25	10	62.5	11	68.75
Total	16	100	16	100	16	100	16	100	16	100	16	100	16	100	16	100

6. Conclusion and Recommendations

This paper examines the efficiency of co-operatives in Malaysia from the year 2010 to 2017. The selection of non-parametric Data Envelopment Analysis (DEA) methodology has allowed us to distinguish between the three different types of efficiency, such as technical, pure technical, and scale efficiency. During this period, co-operatives in Malaysia were efficient since the result shows a 62.3% efficiency level. Hence, we can conclude that co-operatives in Malaysia were quite efficient in utilizing the resources.

Based on our analysis, scale efficiency (SE) dominated the result. This means that the scale and size of co-operatives are important considerations to increase the level of scale efficiency. Since the result shows that pure technical efficiency (PTE) contributed less to the overall technical efficiency (OTE), the management of co-operatives should enhance their managerial performance. For instance, co-operatives in Malaysia could increase their income by offering a variety of products and services. In addition, the governance of the co-operatives could be improved by selecting qualified board members based on their experience, knowledge, and commitment to the co-operatives. This study provides recommendations and solutions to the relevant authorities such as the Malaysian Co-operative Commission to enhance the efficiency of the co-operatives in Malaysia and subsequently improve the overall performance of co-operatives in Malaysia.

Acknowledgement
I would like to thank the Ministry of Education of Malaysia that has sponsored my doctoral study via the MyBrain15 program.

References

1. Alrafadi, K. M., Kamaruddin, B. H., & Yusuf, M. (2014). Efficiency and determinants in Libyan banking. *International Journal of Business and Social Science,* 5(5).
2. Anania, P., Gikuri, A., & Hall, J. N. (2015). SACCOS and Members' expectations: Factors affecting SACCOS capacity to meet Members' expectations. *In Workshop Proceedings of the Co-operative Research Workshop held on 24th March.*

November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

3. Asawaruangpipop, P., &Suwunnamek, O. (2014). Analysis on savings and credit cooperatives efficiency in Thailand: a data envelopment analysis (DEA) approach. *Research Journal of Business Management*, *8*(3), 242-253.
4. Bank Kerjasama Rakyat Malaysia (2014). *2013 annual report of the Bank Kerjasama Rakyat Malaysia.*
5. Bank Negara Malaysia (2011). *Perkembangan Ekonomi Pada Tahun 2011*. Retrieved from http://www.bnm.gov.my/files/publication/ar/bm/2011/cp01.pdf
6. Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision-making units. *European journal of operational research*, 2(6), 429-444.
7. Coelli, T., & Rao, D. G. Battese (1998). An Introduction to Efficiency and Productivity Analysis. Kluwer Academic Publishers.
8. Deller, S., Hoyt, A., Hueth, B., & Sundaram-Stukel, R. (2009). Research on the economic impact of cooperatives. *University of Wisconsin Center for Cooperatives*, 231, 232-3.
9. Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society: Series A (General)*, 120(3), 253-281.
10. Fukuyama, H., Guerra, R., & Weber, W. L. (1999). Efficiency and ownership: evidence from Japanese credit cooperatives. *Journal of Economics and Business*, 51(6), 473-487.
11. Galarza, C. A. R., Campoverde, J. A. C., &Borenstein, D. (2019). Evaluation of the efficiency of savings and credit cooperatives in Ecuador: A Data Envelopment Analysis (DEA) Application. *Contaduría y Administración*, 64(1), 1–17.
12. Hassan, K. M. (2006). The X-efficiency in Islamic banks. *Islamic economic studies*, 13(2).
13. Kipesha, E. F. (2013). Production and intermediation efficiency of microfinance institutions in Tanzania. *Research Journal of Finance and Accounting*, 4(1), 149-159.
14. Koperasi Angkatan Tentera Malaysia Berhad (2014). *2013 annual report of the Koperasi Angkatan Tentera Malaysia Berhad.*
15. Cooperatives could be the third contributor to the economy. (2018, October 30). Astroawani. Retrieved from http://www.astroawani.com/berita-malaysia/koperasi-boleh-jadi-penyumbang-ketiga-ekonomi-dr-hatta-189693
16. Koperasi Felda Sebertak Pahang Berhad. (2017). *2016 annual report of the Koperasi Felda Sebertak Pahang Berhad*.
17. Kumbhakar, S. C., & Lovell, C. K. (2003). *Stochastic frontier analysis*. Cambridge university press.
18. Lensink, R., Meesters, A., & Hermes, N. (2011). Outreach and Efficiency of Microfinance Institutions: is there a trade-off. *World Development*, 39(6), 938-948.
19. Luo, X. (2003). Evaluating the profitability and marketability efficiency of large banks: An application of data envelopment analysis. *Journal of Business research*, 56(8), 627-635.
20. Maamor, S., & Ismail, A. G. (2010). The Ar-Rahnu efficiency and its determinants. *Journal of Islamic Economics, Banking and Finance.*
21. Magali, J. J., &Lang'at, J. (2014). Impacts of Corporate Governance on Efficiency and Sustainability of the Best Rural Saccos in Tanzania. *Global Journal of Commerce Ad Management Perspective*, 3(2), 1-8.
22. Marwa, N., &Aziakpono, M. (2014). Efficiency and Profitability of Tanzanian saving and Credit Cooperatives: Who is a Star? *Journal of Economics and Behavioral Studies*, 6(8), 658–669.
23. Mokhtar, H. S. A., Abdullah, N., & Al-Habshi, S. M. (2006). Efficiency of Islamic banking in Malaysia: A stochastic frontier approach. *Journal of Economic Cooperation*, *27*(2), 37-70.
24. Noor, A. H. M., Rasool, M. S. A., Ali, R. M. Y. S. M., & Rahman, R. A. (2015). Efficiency of Islamic institutions: Empirical evidence of zakat organizations' performance in Malaysia. *Journal of Economics, Business and Management*, 3(2), 282-286.

November-December 2019
ISSN: 0193-4120 Page No. 3989 - 4000

25. Othman, A., & Kari, F. (2008, October). Enhancing co-operative movement to achieve Malaysia's development goals. In *ICA Research Conference* (pp. 1-39).
26. Othman, I. W., Mohamad, M., & Abdullah, A. (2013, January). Cooperative movements in Malaysia: The issue of governance. In *Proceedings of World Academy of Science, Engineering and Technology* (No. 78, p. 831). World Academy of Science, Engineering and Technology (WASET).
27. Park, R., & De, P. (2004). An Alternative Approach to Efficiency Measurement of Seaports. *Maritime Economics & Logistics.*
28. SKM targets RM50bil revenue from cooperatives by 2020. (2018, March 15), *The Star*. Retrieved from https://www.thestar.com.my/business/business-news/2018/03/15/skm-targets-rm50bil-revenue-from-cooperative-movement-by-2020.
29. Sufian, F., Kamarudin, F., & Noor, N. H. H. M. (2012). Determinants of revenue efficiency in the Malaysian Islamic banking sector. *Journal of King Abdulaziz University: Islamic Economics*, 25(2).
30. Suruhanjaya Koperasi diarahberi idea baharukepada 4,000 koperasi tidakaktif. (2018, August 30), *Utusan Online.* Retrieved from https://www.utusan.com.my/berita/nasional/suruhanjaya-koperasi-diarah-beri-idea-baharu-kepada-4-000-koperasi-tidak-aktif-1.738599
31. Wahab, N. A., & Rahman, A. R. A. (2013). Determinants of efficiency of zakat institutions in Malaysia: A non-parametric approach. *Asian Journal of Business and Accounting*, 6(2).
32. Yudistira, D. (2004). Efficiency in Islamic banking: an empirical analysis of eighteen banks. *Islamic Economic Studies*, 12(1).
33. Xiong, X., Tian, J., &Ruan, H. (2011). A DEA-model evaluation of the efficiency of peasant household credit investigation system in rural credit cooperatives: A positive research in Hubei Province, China. *China Agricultural Economic Review*, 3(1), 54-66.

APPENDIX 1

1. Bank Kerjasama Rakyat Malaysia Berhad (Bank Rakyat)
2. KoperasiAnggota Kerajaan Ipoh Berhad
3. KoperasiAngkatanTentera Malaysia Berhad
4. Koperasi Co-OpbankPersatuan Malaysia Berhad
5. KoperasiFeldaSebertak Pahang Berhad
6. Koperasi Guru-Guru Sekolah Malaysia Berhad
7. KoperasiJayadiri Malaysia Berhad(Kojadi)
8. KoperasiKakitangan Bank Rakyat Berhad
9. KoperasiKakitangan Kerajaan Terengganu (Kokitab) Berhad
10. KoperasiKakitangan Petronas Berhad(Kopetro)
11. KoperasiPegawai-Pegawai Kerajaan Negeri Kedah Darul Aman Berhad
12. KoperasiPermodalanFelda Malaysia Berhad
13. KoperasiSerbagunaKakitangan Mas Malaysia Berhad
14. KoperasiSerbausaha Makmur Berhad
15. Koperasi Tenaga NasionalBerhad
16. Koperasi Tunas Muda Sungai Ara Berhad