Efficiency Analysis of Microfinance Institutions in ASEAN: A DEA Approach

Izah Mohd Tahir[1] and Siti Nurzahira Che Tahrim[2]

Abstract

There are very limited studies in the efficiency of microfinance institutions (MFIs) in the Association of Southeast Asian Nations (ASEAN) countries. To the best of our knowledge, there is no research done to compare the efficiency of MFIs in ASEAN countries using Data Envelopment Analysis. Hence, the study on efficiency in this region is significant and will contribute to the existing literatures. The purpose of this paper is to examine and compare the efficiency levels of MFIs in five countries in ASEAN. These countries are Indonesia, the Philippines, Vietnam, Cambodia and Laos. Data Envelopment Analysis with the production approach is employed in this study. The period covers from 2008 to 2010. The results suggest that microfinance institutions in Vietnam are relatively more efficient that their counterparts with efficiency levels of 87.6% in 2008 and 2009, 90.8%in 2010 and 91.3%in 2011. Microfinance institutions in Laos are found to be least efficient (45% in 2008, 43.8%in 2009, 60.8% in 2010 and 62.5% in 2011). Further the results suggest that during the period of study we found that pure technical efficiency is lower than the degree of scale efficiency for Indonesia, Cambodia, Philippines and Vietnam, implying that that during the period of study, the microfinance institutions have been inefficient in controlling their costs rather than operating at the wrong scale. In contrast, in Laos, pure technical efficiency is higher than scale efficiency indicating that microfinance institutions in Laos are operating at the wrong scale of operation rather than producing below the production frontier. The results imply that improvements are suggested especially in reducing excessive usage of inputs.

INTRODUCTION

Microfinance institutions' (MFIs) roles are important in terms of providing access of financial services to the underserved segment of the population. This part of the society is financially excluded by the formal financial institutions because of institutions' unwillingness to extend loans without collateral due to their commercial goals. Despite social goals strived by the MFIs, the sustainability of these institutions is crucial to ensure continuous support. Hence, the efficiency of MFIs is a key in achieving sustainability.

Kipesha (2013) defines efficiency as better use of resources in order to maximize the production of the goods and services of the firms. It is concerned with the relationship between the input resources such as labour costs, capital and equipment and the output produced using the inputs (Farrell, 1957). Efficiency indicates how well organizations utilize their resources to produce goods and services, and the rate at which the input resources are used to produce or deliver the outputs.

According to Farrell (1957) economic efficiency of any firm has two main components: pure technical efficiency (PTE); and allocative efficiency (AE). PTE refers to the ability and willingness of a firm to avoid waste by producing as much output as input usage allows. In other words, firms will not waste their inputs in the production of goods or services. Thus, productive efficiency can be achieved when firms

---

[1] *Research Institute for Islamic Product and Civilization, Universiti Sultan Zainal Abidin, Gong Badak Campus, Kuala Terengganu, Malaysia*
E-Mail: izah@unisza.edu.my

[2] *Faculty of Business Management and Accountancy, Universiti Sultan Zainal Abidin, Gong Badak Campus, Kuala Terengganu, Malaysia*
E-Mail: sitinurzahira.chetahrim@gmail.com

utilize all of their resources efficiently, producing optimal output. Productive efficiency is also called economic efficiency. Allocative efficiency involves the selection of an input mix that allocates factors to their highest value. It a theoretical measure of benefit or utility derived from a proposed or actual selection in the allocation of resources.

Efficiency in MFIs therefore refers to how well MFIs allocate the input resources such as asset, subsidies and personnel to produce output measured in terms of the loan portfolio and poverty outreach (Bassem, 2008). In other words, efficiency of MFIs refers to how well these institutions utilise their inputs to produce optimal outputs. Efficiency measurement in MFIs is also very crucial as it gives information about the firm performance especially on the use of resources and minimization of wastes. It helps organizations in setting their targets for monitoring activities through better management of their bottlenecks and its barriers hindering the performance and also helps the measurement, monitoring and improvements of results leading into increased performance and profitability of the firm.

According to Rosenberg (1994), Reynolds & Thompson (2002), Barres et al. (2005) and Kipesha (2013), efficiency is an important attribute in any organization including MFIs for a number of reasons. Firstly, input resources used by MFIs are scarce and limited since donors are unwilling to fund MFIs to the required capacity to serve all poor clients Secondly, the rapid growth of MFIs sector across the world has increased competition for donor funds. Third reason is the recognition of MFIs by development expertise as a promising and new tool for poverty alleviation that has increased the need for their efficiency in the use of public funds. Fourth, increased competition among MFIs themselves has resulted into lowering interest rates and operating more efficiency. Finally, profitability potentials of microfinance industry have attracted commercial banks and other private investors to engage into microfinance business with efficient operations, better utilization of the resources and reduction of the amount of wasted and most of the donors are now interested in funding MFIs which are sustainable and efficient.

Measures of efficiency studies are divided into parametric and non-parametric methods. Based on banks efficiency studies, common parametric methods are the Stochastic Frontier Approach (SFA), the Thick Frontier Approach (TFA) and the Distribution Free Approach (DFA), while the common non-parametric techniques are the Free Disposal Hull analysis (FDH) and the Data Envelopment Analysis (DEA) (Mokhtar et. al. 2006).

There are very limited studies in the efficiency of MFIs, especially in the poor and developing countries such as in the ASEAN countries, which include Indonesia, Philippines, Cambodia, Vietnam and Laos. To the best of our knowledge, there is no research done to compare the MFIs efficiency of ASEAN countries using Data Envelopment Analysis. Hence, the study on efficiency in this region is significant and will contribute to the body of knowledge: theoretically and practically.

Theoretically, the results in this study will be a starting point for more efficiency comparisons studies of MFIS in the ASEAN region. Subsequently, the results will also set the benchmark for the MFIs in the region to strive for and increase the efficiency level. This study also has practical significance because the industry will benefit by focusing on variables that are identified low in efficiency. It will also assist policy makers to identify and reduce excessive usage or waste of inputs which are not relevant. This will in turn help to increase the sustainability of MFIs in ASEAN region.

The purpose of this study is to analyse the efficiency of MFIs in ASEAN countries using non-parametric Data Envelopment Analysis (DEA). In Section 2 the literatures on efficiency studies will be overviewed. Section 3 will focus on the Data and Methodology and Section 4 presents the results and Discussion. Section 5 is the conclusion.

LITERATURE REVIEW
Although efficiency studies on formal financial institutions such as banks are numerous, the literature in microfinance is somehow very limited. There are remaining gaps for the efficiency study in microfinance which need to be filled, considering the importance of microfinance institutions and their roles to the economy. While efficiency studies can be done using either parametric or non-parametric analysis, most of microfinance studies preferred non-parametric Data Envelopment Analysis (DEA) to parametric Stochastic Frontier Analysis (SFA) due to some limitations of SFA and advantages of DEA. An example is

SFA does not incorporate arguments that are not expressed in monetary units into the function, which is possible for DEA (Kablan, 2012).

Using DEA, Bassem (2008) assessed the efficiency of 35 MFIs in the Mediterranean zone during the period of 2004–2005, using data collected from MIX Market database. Two inputs (number of personnel and total assets) and two outputs (female borrowers and return on assets) are employed under the production approach. Efficiency is run under both constant return to scale (CCR Model) and variable return to scale (BCC Model). In this study, eight MFIs are identified efficient. The study found that a few Non-Bank Financial Institutions (NBFIs) need to reduce size while some non-government organizations (NGOs) are recommended to increase scale to improve efficiency.

Under the production DEA approach, Qayyum & Ahmad (2008) chose loans as single output variable, whereas credit officers and cost per borrower as input variables. The study is on South Asia countries which cover 15 Pakistani, 25 Indian and 45 Bangladeshi MFIs where data are taken from the Micro Finance Network, Pakistan and Mix Market Network. The DEA technical efficiency is calculated by assuming both Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) technology, employing both input and output orientations. Their results suggest that MFIs in Bangladesh are the most efficient followed by India and Pakistan. Efficiency analysis by country revealed some differences of number of efficient MFIs using CRS (three MFIs) and VRS (five MFIs). Based on sustainable criterion i.e. to have more than 10,000 active borrowers (Gow, 2006), 28 MFIs from three countries are considered not sustainable. However, two unsustainable MFIs are found to be efficient. MFIs inefficiencies in Pakistan, Bangladesh and India are mainly technical in nature, of which improved managerial skills and technology can result in better efficiency.

Sedzro & Keita (2009) study MFIs efficiency in seven countries of the West African Economic and Monetary Union (WAEMU) namely Benin, Burkina-Faso, Ivory-Coast, Mali, Niger, Senegal and Togo from 2000 to 2002. The study uses DEA with output orientation and both the CRS and VRS models to measure the efficiency of MFI. This study used unbalanced data with 539 observations, representing 161 in 2000, 210 in 2001 and 168 in 2002. The data come from the data bank, called "Monograph of the Decentralized Financial Systems", which is established from annual reports and financial statements submitted by microfinance institutions of each country to the Central Bank. Both production and intermediation approaches are adopted. As for production approach, the input variables are labour, physical capital and financial capital, while the output variables are number of savers, number of borrowers and investments. In intermediation approach, total deposits, labour and physical capital is selected as input variables to produce outputs which are loans, interest income and investments. The MFIs are most efficient in the 2000 followed by 2001 and 2002 for production approach. On the other hand, under intermediation approach, the MFIs are most efficient in 2000, followed by 2002 and 2001. Overall, the results show that most of the MFI performances are due to their country environment in 2000 and 2001.

Hassan & Sanchez, (2009) study on technical and scales efficiencies of microfinance institutions (MFIs) in three regions: Latin America countries (141 MFIs), Middle East and North Africa (MENA) countries (26 MFIs) and South Asia countries (47 MFIs). The study compares efficiencies across regions and across type of MFIs in 2005. The MFIs in the sample are mainly non-profit (NGO), followed by non-bank financial institutions. DEA method was chosen under two approaches, the production approach and the intermediation approach. The inputs for the intermediation approach are operating expenses, total financial expenses and labour, while the inputs used in the production approach are operating expenses and labour. For intermediation approach, gross loan portfolio, total funds and financial revenues are selected as outputs. As for production approach, single identified output is number of active borrowers. Results show that technical efficiency is higher for formal MFIs (banks and credit unions) than non-formal MFIs (non-profit organizations and non-financial institutions). In addition, South Asian MFIs have higher technical efficiency than Latin American and MENA MFIs. The source of inefficiency is pure technical rather than scale, suggesting that MFIs are either wasting resources or are not producing enough outputs (making enough loans, raising funds, and getting more borrowers).

Haq et al., (2010) examine the cost efficiency of 39 microfinance institutions across Africa, Asia and the Latin America in 2004 using non-parametric data envelopment analysis. Based on some criteria, the

sample consists of 13 bank MFIs, 8 NBFI-MFIs, 6 cooperatives/credit unions MFIs, 11 NGO-MFIs, and another non classified MFI. Both input and output oriented models are applied using the production and intermediation approach for both constant return to scale (CRS) and variable return to scale (VRS) analyses. Inputs selected under production approach are labour, cost per saver and cost per borrower, while selected outputs are number of savers per staff and number of borrowers per staff. Under intermediation approach, total number of staff and operating expenses are identified as inputs, whereas gross loan portfolio and total savings as outputs. Two models are specified. Model 1 incorporates two-stage analysis. In the first stage it uses controllable inputs in computing MFIs efficiency scores. In the second stage of analysis it separates the effect of uncontrollable inputs from the technical efficiency. On the other hand, Model 2 incorporates both uncontrollable and controllable variable as inputs in estimation of DEA efficiency scores. The findings show non-governmental microfinance institutions particularly; under production approach were the most efficient and this result is consistent with their fulfilment of dual objectives: alleviating poverty and simultaneously achieving financial sustainability. However, bank-microfinance institutions also found to be outperformed in the measure of efficiency under intermediation approach. This result reflects that banks are the financial intermediaries and have access to local capital market. It may be possible that bank-microfinance institutions may outperform the non-governmental microfinance institutions in the long run.

The study done by Annim (2010) focus on MFIs efficiency using a balanced panel data of 164 MFIs for the period 2004-2008, extracted from the MIX Market Database. Both parametric (Stochastic Frontier Analysis – SFA) and non-parametric (Data Envelopment Analysis – DEA) efficiency estimation techniques are used. Three-stage analysis were done: 1) DEA techniques using CRS and VRS models to differentiate technical from scale efficiency; 2) parametric Bootstrap to correct bias with second stage truncated regression and 3) Translog cost frontier. This paper also studies the patterns, trends and drivers of efficiency. Instead of using production and intermediation approach options, this study is based on microfinance scope (financial and operation) and MFIs objectives (outreach and sustainability). Variables selected are operating expenses, gross loan portfolio, personnel, financial revenue, women borrowers, cost per staff and cost per loan. Patterns, trends and drivers of the efficiency of microfinance institutions (MFIs) are suggested to be dependent on the scope of financial sustainability measures and on MFIs' inclination to either of the dual objectives of financial systems and outreach. Unlike trade-off between financial efficiency and outreach, social efficiency is found to be positively linked with outreach. Other observation is bureaucracies in property registration and lack of credit information affect negatively on social efficiency.

Ahmad (2011) has attempted a study to estimate the efficiency of MFIs in Pakistan. Non-parametric Data Envelopment analysis has been used to analyse the efficiency of these institutions by using data for the year 2003 (12 MFIs) and 2009 (19 MFIs) respectively. Both input oriented and output oriented methods have been considered under the assumption of constant return to scale (CRS) and variable return to scale (VRS). The outputs selected are gross loan portfolio and number of active borrowers. Total assets and number of personnel are identified as inputs. While conducting DEA analysis for each year, it has been found that out of 12 there are three microfinance institutions that are on efficiency frontier in the year 2003 under both CRS and VRS assumptions. Three MFIs are efficient under CRS assumption and four are efficient under VRS assumption. For the year 2009, out of 19, four MFIs are efficient under CRS and nine are efficient under VRS assumption. There are four MFIs that are efficient under both CRS and VRS. Two efficient MFIs in 2003 do not exist in 2009 anymore. There is a decline in efficiency to most MFIs in 2009 as compared to 2003. Inefficiencies in Pakistan are mainly technical in nature. Improvements in managerial skills and technology are hence needed. Funding gap is identified as a dominant external factor which may be closed by uplifting the prohibition of microfinance banks from pledging security or sourcing foreign currency loans.

Kipesha (2012) studied efficiency of 35 MFIs from five East African countries (Tanzania, Kenya, Uganda, Rwanda and Burundi). Efficiency of MFIs was examined using production efficiency method of non-parametric Data Envelopment Analysis. Input oriented approach was taken for both Constant Return to Scale (CRS) and Variable Return to Scale (VRS). Efficiency for MFIs have mixed results with some has higher efficiency using VRS compared to CRS, some have the same efficiency under both approach. On

average the efficiency trend is increasing from 2009 to 2011. Inefficiency is mainly caused by technical inefficiency. It was observed also that most banks have better efficiency than non-banks financial institutions such as NGOs and Cooperatives. NGOs and Cooperatives are recommended to consider the market structure changes, technology and increased competition to survive.

Kablan (2012) examined the 104 MFIs' efficiency in the West African Economic and Monetary Union (WAEMU) after the reforms that were undertaken in the industry. Given the complementary role between MFIs and banks in outreaching the unbanked, the study attempts to find answer on whether these reforms have promoted sustainability or outreach. Data envelopment analysis (DEA) is used to measure both the social efficiency and financial efficiency of the MFIs. For computation of financial and social efficiency, the input variables are financial expenditure, capital and personnel. Meanwhile the output selected for financial efficiency is gross loan portfolio. For social efficiency, number of active borrowers, poverty index and percentage of women borrowers are specified as outputs. Both CRS and VRS models are adopted. The study further analyse the determinants of efficiency with variables of financial management and risk, variables specific to MFIs and environmental variables. The results show that sustainability prevails. An increase in financial efficiency resulted in decrease of social efficiency. MFIs that stress outreach tend to be less efficient, when one considers their intermediation role. Reforms have dual impacts; a negative impact on social efficiency but a positive impact on financial efficiency. In fact, prudential ratios and accounting standards that were implemented, led MFIs to privilege their intermediation role.

Abdelkader, Jemaa, & Mekki (2012) evaluate the performance of MFIs in the MENA region over the period 2006-2009. The sample constituted an unbalanced data of 61 MFIs from MENA region (Egypt, Iraq, Jordan, Lebanon, Morocco, Palestine, Sudan, Syria, Tunisia and Yemen). The MFIs from these countries are categorised as NGO (46), non-bank financial institutions – NBFIs (10), bank (1) and others (4). This study which employed input orientation DEA used three input variables; total assets, operating expenses and number of employees and two output variables namely indicator of benefit to the poorest (POV) and financial revenue. Additional steps were done to solve problems to non-parametric DEA techniques. In order to test the nature of return to scale of the different MFIs, the study used Simar and Wilson (2002) bootstrap-based approach. o detect outliers of non-parametric estimators of frontiers, a combination of three methods is used. They are the peer-count index (Charnes and al., 1985), the super-efficiency approach (Anderson and Petersen, 1993) and Wilson approach (Wilson, 1993). Only after clearing the data from outliers, a DEA-Bootstrapping methodology is applied, following Simar and Wilson (1998, 2000) to drift appropriate measures of DEA efficiency scores and to construct confidence intervals. The estimated results show that average efficiency of the most countries of the region has dropped over the period under study. Other interesting observation is that the efficiency scores of NGO are significantly greater than those of the NBFI.

Jayamaha (2012), on the other hand, evaluated the efficiency of small financial institutions (SFIs) in Sri Lanka. The study was conducted from 2005 to 2010 by taking all 1,933 CRBs operating in 2010. Data envelopment analysis (DEA) is used to measure efficiency. Deposits, number of deposit accounts and number of branches have been identified as inputs while outputs comprise of loans and advances and number of loans and advances accounts. Technical Efficiency, Pure Technical Efficiency and Scale Efficiency are computed using CRS and VRS models. The efficiency analyses are done by size as well as by location. The efficiency of CRBs in Sri Lanka has declined during the study period of 2005 to 2010. There were also significant differences in the efficiency of CRBs by geographical locations. The efficient banks are also found closely associated with size of the banks.

A more recent study by Kipesha (2013) used input oriented approach while Singh, Goyal, & Sharma (2013) used input and output orientation. Both studies used production and intermediation approaches. The studies were done on Tanzanian and Indian MFIs respectively. Kipesha (2013) concluded that the MFIs in Tanzania are efficient as producer and inefficient as intermediary, indicating better allocation of input resources in the production of outputs. The study contradicted earlier studies which reported inefficiency under both production and intermediation approach and non-banks to have lesser efficiency than commercial banks and pure MFIs. Recommended solutions for inefficient MFIs include improvement in terms of scale and resource allocations.

DATA AND METHODOLOGY
Data
This study investigates the efficiency levels of microfinance institutions in five countries in ASEAN; Indonesia, Cambodia, the Philippines, Laos and Vietnam, using the data for the year 2008 to 2011. The data used has been gathered from MIX Market database. Table 1 presents the number of microfinance institutions IN Indonesia, Cambodia, the Philippines, Laos and Vietnam available for analysis.

Table 1: Country and Data Available for Analysis, 2008-2011

	2008	2009	2010	2011
Indonesia	38	20	22	17
Cambodia	15	17	17	16
Philippines	66	69	54	42
Laos	3	1	3	11
Vietnam	18	17	15	25
Total				

Methodology
Two main approaches to measure technical efficiency of MFIs are production approach and intermediation approach. In production approach, MFIs are considered as producers of deposits and loans using input resources such as assets, capital and personnel (Haq et al., 2010; Bassem, 2008). To estimate production efficiency, some empirical studies employed asset, personnel and operating costs as inputs variables used to produce loan portfolio, financial revenue or number of active borrowers as the output (Kipesha, 2013; Bassem, 2008; Ahmad, 2011).

On the other hand, MFIs are considered as financial intermediary in intermediation approach that mobilize funds in terms of deposits and borrowings from surplus units and offer them as loans to the poor clients with deficits. While intermediation approach is highly suitable for financial institutions, its application in MFIs is limited. Due to the nature of most of MFIs which use debts instead deposits to provide loans to the poor clients, production approach dominated MFIs technical efficiency measures (Bassem, 2008; Ahmad, 2011). Among the empirical studies which employed intermediation efficiency include Haq et al. (2010) which estimates intermediation efficiency of microfinance institution in Vietnam using cost per borrower, cost per saver and operating expenses as input proxy for funds mobilize to produce gross loan portfolio and Molinero et al. (2004) which employed number of credit officers and operating expenses as input variables to produce number of loans outstanding, gross loan portfolio and interest and fee income.

In this study we employed the production approach with total assets and operating expenses as inputs while gross loan portfolio and number of active borrowers are treated as outputs. A non-parametric measure, the DEA is used. It is non-parametric because it requires no assumption on the shape or parameters of the underlying production function. DEA is a linear programming technique based on the pioneering work of Farrell's efficiency measure (1957), to measure the different efficiency of decision-making units (DMUs). Assuming the number of DMUs is s and each DMU uses m inputs and produces n outputs. Let DMU_k be one of s decision units, $1 \leq k \leq s$. There are m inputs which are marked with X_i^k ($i = 1, ..., m$), and n outputs marked with Y_j^k ($j = 1,...., n$). The efficiency equals to total outputs divided by total inputs. The efficiency of DMU_k can be defined as follows:

$$\text{The efficiency of } DMU_k \quad = \quad \frac{\sum_{j=1}^{n} u_j \, Y_j^k}{\sum_{i=1}^{m} v_i \, X_i^k} \tag{1}$$

$X_i^k, Y_j^k \geq 0,\ i = 1, \ldots, m,\ j = 1,\ldots,\ n,\ k = 1,\ldots,\ s$

$u_j, v_i \geq 0,\ i = 1,\ldots,m,\ j = 1,\ldots,n$

The DEA program enables one to find the proper weights which maximise the efficiency of DMU and calculates the efficiency score and frontier. The CCR model originated by Charnes *et. al*. (1978), has led to several extensions, most notably the BCC model by Banker *et. al*. (1984). The CCR and BCC models can be divided into two terms; one is the input oriented model; the other is the output oriented model. The input orientation seeks to minimize the usage of inputs given a fixed level of output while the output orientation maximizes the level of output for a given level of inputs. In CCR model, constant returns to scale (CRS) is assumed, which means one unit of input can get a fixed value of output. The BCC model assumes variable returns to scale (VRS).

In this study we chose the input oriented model and used the dual problem model to solve the problems. The CCR dual model is as follows:

$$\text{Min } \theta - \varepsilon \left[\sum_{i=1}^{m} S_i^- + \sum_{k=1}^{n} S_j^+ \right] \tag{2}$$

$$s.t. \quad \sum_{i=1}^{s} \lambda_r X_i^r - \theta X_i^k + S_i^- = 0 \qquad i = 1, \ldots, m$$

$$\sum_{i=1}^{s} \lambda_r Y_j^r - S_i^+ = Y_j^r \qquad j = 1, \ldots, n$$

$\lambda_r \geq 0 \quad r = 1,\ldots,\ s$

$S_i^- \geq 0 \quad i = 1,\ldots,\ m$

$S_j^+ \geq 0 \quad j = 1,\ldots,\ n$

Where
θ is the efficiency of DMU
S_i^- is the slack variable which represents the input excess value
S_j^+ is the surplus variable which represents the output shortfall value
ε is a non-Archimedean number represents a very small constant
λ_r means the proportion of referencing DMU_r when measuring the efficiency of DMU_k
If the constraint below is adjoined, the CCR dual model is known as the BCC model.

$$\tag{3}$$

$\sum_{r=1}^{s} \lambda_r = 1$

Equation (3) frees CRS and modifies BCC model to be VRS. For the measurement of efficiency, the CCR model measures overall efficiency (OE) of a DMU, and the BCC model can measure both the pure technical efficiency (PTE) and scale efficiency (SE) of DMU. The relationship of OE, PTE and SE is as the equation (4) below.

OE = PTE X SE   (4)

DEA technique has been applied successfully as a performance measurement tool in many fields including the manufacturing sector, hospitals, pharmaceutical companies, banks, education and transportation.
In this study, an input orientation as opposed to output orientation has been adopted. Based on past studies, input was measured by both total assets and operating expenses. Output was measured in terms of gross loan portfolio and number of active borrowers. Table 2 presents the descriptive statistics of the outputs and inputs used in the study.

Table 2: Descriptive Statistics for Outputs and Inputs Used, 2008-2011 (In USD Million)

Variables	Abbv.	Mean	Std Dev.	Min	Max
2008					
Gross Loan Portfolio	Q_1	31.53	257.37	0.04	3,017.87
Number of active borrowers	Q_1	76.46	574.40	0.21	6,792.980
Total Assets	X_1	36.37	271.08	0.07	3,143.45
Operating Expenses	X_2	3.45	19.42	0.05	221.35
2009					
Gross Loan Portfolio	Q_1	43.83	355.16	0.05	3,929.04
Number of active borrowers	Q_1	95.42	677.03	0.180	7,536.96
Total Assets	X_1	50.60	369.14	0.00	4,026.35
Operating Expenses	X_2	4.49	26.43	0.05	285.52
2010					
Gross Loan Portfolio	Q_1	59.30	439.77	0.01	4,588.94
Number of active borrowers	Q_1	118.02	775.79	0.12	8,166.29
Total Assets	X_1	68.12	460.34	0.02	4,732.20
Operating Expenses	X_2	4.69	18.29	0.05	174.19
2011					
Gross Loan Portfolio	Q_1	66.49	476.16	0.00	4,932.54
Number of active borrowers	Q_1	123.65	810.03	0.03	8,519.5
Total Assets	X_1	75.98	503.95	0.00	5,122.36
Operating Expenses	X_2	5.04	19.20	0.05	179.84

Note: Number of active borrowers are in thousand

RESULTS AND DISCUSSION
Efficiency analysis
All the computation for the efficiency scores were done by DEAP program. The efficiency of the microfinance institutions in ASEAN was examined using a separate frontier for each year. Table 3 reports the descriptive statistics of the efficiency scores for year 2008 to 2011.

For 2008, our results show that Vietnam has the highest efficiency score (87.6%) followed by   Cambodia (74.6%), Indonesia (68%), Philippines (65.9%), while Laos recorded the lowest mean efficiency score

(45%). Overall mean efficiency is 69.7% suggesting that these institutions are wasting 30.3% of their inputs and these need improvement.

For the year 2009, overall mean efficiency of the microfinance institutions in ASEAN is 69.7% similar in 2008 with the source of efficiency is pure technical inefficiency. Vietnam recorded the highest mean efficiency score (86.7%), indicating that they are managerially efficient in controlling costs compared to the other counterparts. Laos recorded the lowest (43.8%). In 2010 and 2011, the mean efficiency scores of the microfinance institutions in ASEAN have improved to 75% and 75.4% respectively. The efficiency scores of the institutions in Laos have improved tremendously, from 43.8% in 2009 to 60.8% in 2010 and 62.5% in 2011. However, it is interesting to note that the degree of technical efficiency for microfinance institutions in Indonesia, Cambodia, the Philippines and Vietnam are lower than the degree of scale efficiency, which indicate that a portion of overall inefficiency is due to producing below the production frontier rather than producing on an inefficient scale. However, pure technical efficiency dominates the scale efficiency of microfinance institutions in Laos suggesting that these institutions appeared to produce on inefficient scale.

Table 3: Efficiency Analysis of Microfinance Institutions in ASEAN, 2008-2011

Year/Country	TE	PTE	SE	Year/Country	TE	PTE	SE
2008				**2009**			
Indonesia	0.680	0.757	0.910	Indonesia	0.715	0.776	0.928
Cambodia	0.746	0.807	0.928	Cambodia	0.772	0.845	0.915
Philippines	0.659	0.705	0.943	Philippines	0.635	0.727	0.889
Laos	0.450	1.000	0.450	Laos	0.438	1.000	0.438
Vietnam	0.876	0.934	0.939	Vietnam	0.867	0.918	0.945
Mean	**0.697**	**0.766**	**0.921**	**Mean**	**0.697**	**0.779**	**0.903**
Median	0.693	0.743	0.958	Median	0.677	0.77	0.942
Std Dev	0.158	0.173	0.118	Std Dev	0.169	0.176	0.122
Skewness	-0.417	-0.277	-3.589	Skewness	0.058	-0.193	-2.877
2010				**2011**			
Indonesia	0.759	0.797	0.960	Indonesia	0.661	0.705	0.941
Cambodia	0.821	0.835	0.985	Cambodia	0.838	0.849	0.987
Philippines	0.688	0.724	0.961	Philippines	0.698	0.739	0.956
Laos	0.608	0.881	0.723	Laos	0.625	0.854	0.761
Vietnam	0.908	0.932	0.974	Vietnam	0.913	0.951	0.959
Mean	**0.750**	**0.788**	**0.960**	**Mean**	**0.754**	**0.809**	**0.940**
Median	0.753	0.791	0.999	Median	0.765	0.813	0.993
Std Dev	0.161	0.164	0.109	Std Dev	0.176	0.169	0.133
Skewness	-0.542	-0.426	-4.46	Skewness	-0.927	-1.128	-3.043

Further our results suggest that the inefficiency of microfinance institutions in ASEAN is attributed to pure technical inefficiency rather than scale efficiency. These results suggest that, the authority in these countries need to do something so that these institutions could improve their efficiency levels by investigation on the waste of inputs.

Composition of production frontiers

As mentioned earlier that our results indicate that most of the technical inefficiency exhibited by the microfinance institutions in ASEAN stem from operating below the production frontier rather than producing on an inefficient scale, this study then examines further the trend in the returns of the scale of the microfinance institutions in ASEAN. The results are reported in Table 4.

The results suggest that the share scale efficient banks (CRS) were small in 2008, 2009 and 2011. However, it appears that the share of scale efficient banks was quite high in 2010. The share of microfinance institutions experiencing economies of scale (IRS) was high in 2008 and 2010. In contrast, the share of microfinance institutions experiencing diseconomies of scale (DRS) was high in 2009 and 2011.

Table 4: Composition of Production Frontiers

Year	Country	No	IRS (%)	DRS (%)	CRS (%)	Total (%)
2008	Indonesia	38	82	16	3	100
	Cambodia	15	20	73	7	100
	Philippines	66	41	53	6	100
	Laos	3	100	0	0	100
	Vietnam	18	67	17	17	100
2009	Indonesia	20	15	80	5	100
	Cambodia	17	12	88	0	100
	Philippines	69	16	80	4	100
	Laos	1	100	0	0	100
	Vietnam	17	12	76	12	100
2010	Indonesia	22	45	9	45	100
	Cambodia	17	29	12	59	100
	Philippines	54	33	17	50	100
	Laos	3	67	0	33	100
	Vietnam	15	53	20	27	100
2011	Indonesia	17	24	71	6	100
	Cambodia	16	0	100	0	100
	Philippines	42	17	71	12	100
	Laos	11	91	9	0	100
	Vietnam	25	36	32	32	100

CONCLUSION

The objective of this study is to investigate the efficiency of microfinance institutions in five countries in ASEAN: Indonesia, Cambodia, the Philippines, Laos and Vietnam, during the period of 2008-2011. Using a non-parametric approach, Data Envelopment Analysis enables us to distinguish between technical, pure technical and scale efficiencies.

The results suggest that the mean overall or technical efficiency is 69.7% in 2008 and 2009 and increased to 75% and 75.4% in 2010 and 2011 respectively.

During the period of study, we found that the overall or technical efficiency of the Vietnam microfinance institutions are relatively higher than the other counterparts. In contrast, microfinance institutions in Laos exhibited the lowest efficiency, 45% in 2008, 43.8% in 2009, 60.8% in 2009 and 62.5% in 2011. However, the efficiency levels of the microfinance institutions in Laos have improved during the period under investigation.

During the period of study we found that pure technical efficiency is lower than the degree of scale efficiency for Indonesia, Cambodia, Philippines and Vietnam, implying that that during the period of study, the microfinance institutions have been inefficient in controlling their costs rather than operating at the wrong scale. In contrast, in Laos, pure technical efficiency is higher than scale efficiency indicating that microfinance institutions in Laos are operating at the wrong scale of operation rather than producing below the production frontier.

This study is hoped to carry significant contribution to theory and application in the field as no study to-date was done on MFIs in ASEAN. The proposed framework has potential to catalyst more initiatives in the study of MFIs efficiency in this part of the globe, which in turn could promote further lessons exchanging and improvement in the level of efficiencies of the countries in this region.

REFERENCES

Abdelkader, B., Jemaa, B., & Mekki, M. (2012). Microfinance Institutions' Efficiency in the MENA region: a Bootstrap-DEA approach.

Ahmad, U. (2011). Efficiency Analysis of Microfinance Institutions in Pakistan. *Munich Personal RePEc Archive*, (34215). Retrieved from http://mpra.ub.uni-muenchen.de/34215/

Annim, S. K. (2010). Microfinance efficiency trade-offs and complementarities. Manchester.

Barres, I., Curran, L., Nelson, E., Bruett, T., Escalona, A., Norell, D., Stephens, M. (2005). *Measuring Performance of Microfinance Institutions: A Framework for Reporting, Analysis and Monitoring*. (T. Bruett, Ed.). Washington, USA: The Seep Network and Alternative Credit Technologies, LLC.

Bassem, B. S. (2008). Efficiency of Microfinance Institutions in the Mediterranean: An Application of DEA. *Transition Studies Review*, *15*(2), 343–354. doi:10.1007/s11300-008-0012-7

Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of Royal Statistical Society*, *120*(3), 253–281.

Haq, M., Skully, M., & Pathan, S. (2010). Efficiency of Microfinance Institutions: A Data Envelopment Analysis. *Asia Pacific Financial Markets*, *17*(1), 63–97. doi:10.1007/s10690-009-9103-7

Hassan, M. K., & Sanchez, B. (2009). Efficiency Analysis of Microfinance Institutions in Developing Countries. Indiana.

Hermes, N., Lensink, R., & Meesters, A. (2011). Outreach and Efficiency of Microfinance Institutions. *World Development*, *39*(6), 938–948.

Jayamaha, A. (2012). Efficiency of Small Financial Institutions in Sri Lanka using Data Envelopment Analysis. *Journal of Emerging Trends in Economics and Management Sciences*, *3*(5), 565–573.

Kablan, S. (2012). Microfinance Efficiency in the West African Economic and Monetary Union: Have Reforms Promoted Sustainability or Outreach? *Munich Personal RePEc Archive*, (39955).

Kipesha, E. F. (2012). Efficiency of Microfinance Institutions in East Africa : A Data Envelopment Analysis. *European Journal of Business and Management*, *4*(17), 77–88.

Kipesha, E. F. (2013). Production and Intermediation Efficiency of Microfinance Institutions in Tanzania. *Research Journal of Finance and Accounting*, *4*(1), 149–160.

Mokhtar, H. S. A., AlHabshi, S. M., & Abdullah, N. (2006). A Conceptual Framework for and Survey of Banking Efficiency Study. *UNITAR E-Journal*, *2*(2), 12–13.

Molinero, C. M., Cinca, C. S., & Nieto, B. G. (2007). Microfinance Institutions and Efficiency. *Omega*, *35*(2), 131–142.

Qayyum, A., & Ahmad, M. (2008). Efficiency and Sustainability of Microfinance. *Munich Personal RePEc Archive*, (11674).

Reynolds, D., & Thompson, G. (2002). *Multiunit Restaurant Productivity Assessment: A Test of Data-Envelopment Analysis*. Cornell University, Ithaca, NY.

Rosenberg, R. (1994). *Beyond Self-Sufficiency: Licensed Leverage and Microfinance Strategy*.

Sedzro, K., & Keita, M. (2009). Assessing The Efficiency of The Efficiency of Microfinance Institutions Using Data Envelopment Analysis. *Journal of International Finance and Economics*, *9*(2), 54–68.

Singh, S., Goyal, S. K., & Sharma, S. K. (2013). Technical Efficiency and Its Determinants in Microfinance Institutions in India: A Firm Level Analysis. *Journal of Innovation Economics*, *1*(11), 15 – 31. doi:10.3917/jie.011.0015