

**EFFICIENCY OF ISLAMIC BANKS:
A COMPARISON BETWEEN MALAYSIA AND BAHRAIN**

By

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ABSTRACT

Malaysia and Bahrain are leading as Islamic financial hubs and play a vital role to other countries. In competitive industry, both countries should enhance the performance in terms of efficiency. Hence, the main purpose of this study is to examine the efficiency level of Islamic banks in Malaysia and Bahrain over the period 2008 to 2012. The sample consists of 16 Islamic banks in Malaysia and 15 Islamic banks in Bahrain. Specifically, the aim of the study is to calculate overall technical efficiency (OTE) and its decomposition which are pure technical efficiency (PTE) and scale efficiency (SE) of Islamic banks between Malaysia and Bahrain. A non-parametric based Data Envelopment Analysis (DEA) was used to estimate the efficiency and this study were analyzed based on intermediation approach. Then, a series of parametric and non-parametric test is utilized in order to compare the efficiency level between Malaysia and Bahrain. As a result, Islamic banks in Bahrain were more efficient compared to Islamic banks in Malaysia.

Keywords: Efficiency, Islamic Financial Hubs, Data Envelopment Analysis

ABSTRAK

Malaysia dan Bahrain merupakan negara terkemuka sebagai hab kewangan Islam dan memainkan peranan yang penting terhadap negara-negara lain. Dalam industri yang berdaya saing, kedua-dua negara perlu meningkatkan prestasi dari segi kecekapan. Justeru, tujuan kajian utama ini adalah untuk mengkaji tahap kecekapan bank-bank Islam di Malaysia dan Bahrain dalam tempoh 2008 hingga 2012. Sampel kajian terdiri daripada 16 buah bank-bank Islam di Malaysia dan 15 buah bank-bank Islam di Bahrain. Secara khusus, tujuan kajian ini adalah untuk mengira kecekapan keseluruhan teknikal (OTE), kecekapan teknikal tulen (PTE) dan kecekapan skala (SE) bank-bank Islam antara Malaysia dan Bahrain. Kaedah bukan parametrik berasaskan Data Envelopment Analisis (DEA) telah digunakan dan kajian ini telah dianalisa berdasarkan pendekatan pengantaraan. Seterusnya, satu siri ujian parametrik dan bukan parametrik digunakan untuk membandingkan tahap kecekapan antara Malaysia dan Bahrain. Hasilnya, bank-bank Islam di Bahrain lebih cekap berbanding dengan bank-bank Islam di Malaysia.

Kata Kunci: kecekapan, hab kewangan Islam, Data Envelopment Analisis

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LIST OF ABBREVIATIONS

BCR	Banker Charnes Cooper
BIMB	Bank Islam Malaysia Berhad
BMMB	Bank Muamalat Malaysia Berhad
BNM	Bank Negara Malaysia
CBB	Central Bank of Bahrain
CCR	Charnes Cooper Rhodes
CRS	Constant Return to Scale
DEA	Data Envelopment Analysis
DFA	Distribution Free Approach
DMU	Decision Making Unit
DRS	Decreasing Return to Scale
FDH	Free Disposable Hull
GCC	Gulf Cooperation Council
IBS	Islamic Business Scheme
IRS	Increasing Return to Scale
OIC	Organization of Islamic Conference
OTE	Overall Technical Efficiency
PTE	Pure Technical Efficiency
RTS	Return to Scale
SE	Scale Efficiency
SFA	Stochastic Frontier Approach
SPSS	Statistical Package for the Social Sciences
TFA	Thick Frontier Approach
VRS	Variable Return to Scale

CHAPTER 1

INTRODUCTION

1.1 Introduction

An Islamic banking is a financial institution that operates with the objective to implement and realize the principles of economics and finance in the banking sector. The Organization of Islamic Conference (OIC) defined an Islamic bank as a financial institution whose statutes, rules and procedures expressly state its commitment to the principles of Islamic Shariah and to the banning of the receipt and payment of interest on any of its operations.

Previously, the term “Islamic banking business” under “Islamic Banking Act 1983” was generally defined as the operations of banking activities whose not involve in any forbidden element which is clearly not allowed in Islam. Islamic Financial Services Act 2013 defined “Islamic banking business” as an activities of accepting Islamic deposits either on current, deposit and saving account. It also includes of accepting money under investment account, financial provisions and such other activities.

Nowadays, the Islamic banking industry is seen as a viable alternative in offering a wide range of products and services and expands in all parts of the world. Initially, it was developed to meet the needs of Muslims and now it is widely accepted even among non-Muslims. This industry became as one of the rapid growing sector and across the global banking industry.

According to El Qorchi (2005), there are more than 300 Islamic financial institutions worldwide which consists of 75 countries. Mostly, these industries are concentrated in the Middle East and Southeast Asia as well as in Europe and the United States. Bahrain and Malaysia became the biggest hubs in this industry. At present, the industry has been the main driving force of the global Islamic finance with an estimated asset size of USD1.27 trillion as at the end 2012 or 80.4% of Islamic finance assets worldwide. In year 2007 and 2011, Islamic banking assets have grown at 21.1% per annum (Grewal, 2013).

1.2 History of Islamic Banking Industry

1.2.1 Malaysia

Malaysia is among the first countries to implement the banking system as a dual banking system where Islamic banking system operates in parallel with the conventional banking system. Indirectly, this model of banking system got many recognitions from many Islamic countries which want to practice the model in their respective countries.

In fact, delegates from various countries, mainly Muslim countries, have come to Malaysia, especially to the Central Bank and Bank Islam Malaysia Berhad (BIMB), to study how the dual banking systems work. The system of Islamic banking is divided into two which are full-fledged Islamic banks and Islamic windows. Bank Islam Malaysia Berhad (BIMB) and Bank Muamalat Malaysia Berhad (BMMB) are two full-fledged Islamic bank in this country.

In year 1963, Tabung Haji (the Pilgrims Management and Fund Board) was established by the government. The purpose of establishment is to provide a proper fund management in order to assist Muslims to perform hajj in Mecca. At the same time, to encourage them to take part in investment opportunities and economic activities. Due to its uniqueness, Tabung Haji is regarded as the first of its kind in the world (Mohammed,2002). Then, the government of Malaysia had introduced a systematic process and well-coordinated of performing the Islamic financial system. There are three phases involved in this process, first phase (1983-1992), second phase (1993-2003) and third phase (2004 onwards).

First Phase (1983-1992)

The first phase is regarded as the familiarisation time (1983-1992). In this phase, Bank Islam Malaysia Berhad (BIMB) was established as the first Islamic bank in Malaysia and began its operation on 1 July 1983. Islamic Banking Act 1983 is the legal basis during the setting-up process of BIMB. It indicates that the bank was allowed to perform banking activities as lay down in Shariah principles or Islamic laws.

From 1983 to 1993, BIMB had enjoyed a decade of monopoly as the only provider of banking services based on Islamic principles. That special proper given to BIMB was allow the financial institution to produce as many Islamic products and services as possible in the industry. It was also intended, in a way, to protect the bank from having to compete with other conventional banks.

Second Phase (1993-2003)

Following a wonderful achievement in the first phase, the long term objectives of banks have been mapped out for the next phase (Khalid, 1996). The next phase from 1993 to 2003, was aimed at developing a more conducive environment for competition among the banks. As the purpose was to create awareness among the public either Muslims and non-Muslims about the benefits of Islamic banking system, conventional banks were permitted to offer Islamic banking services by setting up “Islamic windows” in 1993.

The aim of Islamic banking system is to create a system which is not involve any forbidden elements in order to operate together with conventional banking system. To meet these objectives, the Central Bank of Malaysia decided to implement a gradual and step by-step approach.

The first step refers to introduction of “Skim Perbankan Tanpa Faedah” or interest-free banking scheme in 1993 whereby the conventional banks were permitted to offer similar Islamic banking services as the full-fledged Islamic bank did. In December 1998, the term interest-free banking scheme used for Islamic windows was changed by Islamic Banking Scheme (IBS). In that year, all banking institutions which have Islamic windows were also required to upgrade the Islamic banking unit to Islamic banking division so as to further develop the Islamic banking industry.

The second full-fledged Islamic bank which is Bank Muamalat Malaysia Berhad (BMMB) was also established in this phase. The establishment of BMMB was the consequences of merger plans between Bank Bumiputera Malaysia Berhad and Bank of Commerce Malaysia Berhad. With the merger, Bank Islam stands to lose its monopoly status as the only full-fledged Islamic bank. The development of BMMB can ensure balance competition for Bank Islam, which comes under regular criticism from the press around recent decades for the over-cautious and bureaucratic approach (Hashim, 2002).

Third Phase (2004 onwards)

The next phase that began from 2004 which was the duration of further economic liberalisation. During this time, the Central Bank opened the way for new foreign Islamic banks to operate in Malaysia by issuing licences to them.

The distinctive feature of this phase is that the government had brought forward the financial liberalisation of the Islamic banking industry from 2004 to 2007. As a result, there are three of foreign full-fledged Islamic banks, all of them from the Middle East. The purpose of this strategy is to generate more competition as well as to tap new growth opportunity. It may raise the performance of the Islamic banking industry as a whole.

Kuwait Finance House was the first full-fledged foreign Islamic bank issued with license to operate in Malaysia, while the second was Al Rajhi Banking and Investment Corporation. Besides that, all the Islamic windows or IBS were encouraged to set up into Islamic subsidiary, which will be licensed as full-fledged Islamic banks. The goal is to strengthen and stimulate the growth of the local-based Islamic banks as well as to build up them to enhance offshore. The list of 16 Islamic Banks were operated in Malaysia as follow in Table 1.1 (Bank Negara Malaysia, 2009).

Table 1.1
List of Islamic Banks in Malaysia

No.	Name of Islamic Banks	Ownership
1.	Affin Islamic Bank Berhad	Local
2.	Al-Rajhi Banking and Investment Corporation (Malaysia) Berhad	Foreign
3.	Alliance Islamic Bank Berhad	Local
4.	Am Islamic Bank Berhad	Local
5.	Asian Finance Bank Berhad	Foreign
6.	Bank Islam Malaysia Berhad	Local
7.	Bank Muamalat Malaysia Berhad	Local
8.	CIMB Islamic Bank Berhad	Local
9.	Hong Leong Islamic Bank Berhad	Local
10.	HSBC Amanah Malaysia Berhad	Foreign
11.	Kuwait Finance House (Malaysia) Berhad	Foreign
12.	Maybank Islamic Berhad	Local
13.	OCBC Al-Amin Bank Berhad	Foreign
14.	Public Islamic Bank Berhad	Local
15.	RHB Islamic Bank Berhad	Local
16.	Standard Chartered Saadiq Berhad	Foreign

Source: Bank Negara Malaysia (BNM) update (2009), retrieved on 5/5/2014

1.2.2 Bahrain

Bahrain is a member of the Gulf Cooperation Council (GCC) with Kuwait, Qatar, Saudi Arabia and United Arab Emirates. The vision of Bahrain for 2030 is to identify the financial sector as one of the five economic sectors that the country is trying to promote (Al-Ajmi et al., 2009). Bahrain has become leading financial centre in the Middle East since the establishment of its offshore banking sector in October 1975 which make the number of international banks set up their offshore operation in Bahrain.

Then, Islamic banking industry began in 1979 with the establishment of the Bahrain Islamic Bank as the first Islamic bank. The Central Bank of Bahrain (CBB) is responsible for maintaining monetary and financial stability in the Kingdom of Bahrain. It succeeded the Bahrain Monetary Agency, which had previously carried out central banking and regulatory functions since its establishment in 1973. During recent years, Bahrain has rapidly become a global leader in Islamic finance, playing host to the largest concentration of Islamic financial institutions in the Middle East.

Bahrain has become major centres for Islamic finance as many Islamic banks and Islamic financial institutions have been established which makes Bahrain become pre-eminent Islamic financial centres in the Middle East. Currently, Bahrain has 23 Islamic banks which comprise of six retail Islamic banks and seventeen wholesale Islamic banks registered under Central Bank of Bahrain (Central Bank of Bahrain, 2014).

The emergence of Bahrain as the hub of Islamic banking and finance has added another dimension to the diversify of the financial activities and services available in the Gulf region. According to Lewis and Algaoud (2001), this emergence is due to several strategic factors such as its strategic location which located in the Middle East and Gulf Region area. Besides its strategic location, there are a wide range of infrastructure and facilities as well as concentration in Islamic banking with their specialized expertise and well educated trainees in this industry.

Bahrain has been able to attract foreign investor from western countries to participate in Islamic banking industry including Citibank and HSBC Bank. Furthermore, Bahrain able to show their financial innovations in Islamic banking industry such as Bahrain Islamic Bank has become pioneer in the issuance of sukuks (Islamic bonds) which enlisted in the stock exchange (Bahrain Monetary Agency, 2004). Besides that, by having supportive regulatory environment by the Central Bank of Bahrain also has contributed to the excellence of Bahrain as Islamic financial centres in continuing participate in the Islamic financial industry. Table 1.2 below shows the list of Islamic banks in Bahrain as follows:-

Table 1.2
List of Islamic Banks in Bahrain

No.	Name of Islamic Banks	Types
1.	Al-Baraka Islamic Bank B.S.C	Retail
2.	Al-Salam Bank B.S.C	Retail
3.	Bahrain Islamic Bank B.S.C	Retail
4.	Ithmaar Bank B.S.C	Retail
5.	Khaleeji Commercial Bank B.S.C	Retail
6.	Kuwait Finance House B.S.C	Retail
7.	ABC Islamic Bank	Wholesale
8.	Al-Baraka Banking Group B.S.C	Wholesale
9.	Arab Islamic Bank	Wholesale
10.	ARCAPITA Bank B.S.C	Wholesale
11.	Bank Al-Khair B.S.C	Wholesale
12.	Capinnova Investment Bank B.S.C	Wholesale
13.	Citi Islamic Investment Bank B.S.C	Wholesale
14.	First Energy Bank B.S.C	Wholesale
15.	Global Banking Corporation B.S.C	Wholesale
16.	Gulf Finance House B.S.C	Wholesale
17.	Ibdar Bank B.S.C	Wholesale
18.	International Investment Bank B.S.C	Wholesale
19.	Investment Dar Bank B.S.C	Wholesale
20.	Investors Bank B.S.C	Wholesale
21.	Liquidity Management Centre B.S.C	Wholesale
22.	Seera Investment Bank B.S.C	Wholesale
23.	Venture Capital Bank B.S.C	Wholesale

Source: Central Bank of Bahrain (CBB), (2014)

1.3 Background of the Study

Evaluation of performance and productivity is among the fundamental concepts in management. In order to achieve the goals, organizations must evaluate their performance. One of the important stages of performance appraisal is evaluation of organization's efficiency. Banks, financial and credit institutions are among the most important organizations of every economic system, because every activity which entails asset acquisition and financial resources undoubtedly requires mediation of banks and financial organizations. The efficiency of financial institutions is so important for the whole economic safety and prosperity, especially when the financial intermediation is the main financial mechanism of the economical growth.

A bank can be considered efficient if any institution can limit the waste of an economy wealth through the distribution of bad loans and promotes the whole welfare of the economy by optimizing the use of its resources. Among the virtues of the Islamic financial principles is the improvement of the banks efficiency.

Hence, banks play a vital role in developing the different economic sectors, the stream of money is managed and controlled, investment opportunities are utilized and channels of funds can achieve target productive and profitable projects. The efficiency of the financial institutions is crucial for the whole economy, bank failures become a threat on the banking system. Due to the failure of risk, several models and techniques were developed in order to evaluate and analyze the bank's efficiency and performance.

In banking industry, the banking efficiency is defined as difference between observed quantity of input and output variables with respect to optimal quantity of input and output variables. The efficient bank can be achieved through a maximum value of one in comparison to inefficient bank can reduce to level of zero.

1.4 Problem Statement

Since early 1990s, studies that were focused on the efficiency of financial institutions have become an important part of banking literature (Berger and Humphrey, 1997). Perhaps, one of the reasons is, efficiency can be used as an indicator to measure a bank's success. Specifically, using the efficiency criterion, the performance of individual banks as well as the industry can be gauged. Another reason is that the efficiency can also be used to investigate the potential impact of government policies on a bank's efficiency. Indeed, it is of regulators interest to know the impact of their policy decisions on the performance and efficiency of the banks, as they will enormously affect the economy.

Malaysia is at the forefront in the development of Islamic banking, takaful and Islamic capital market. It has a strong and comprehensive Islamic financial system with a robust business driven regulatory regime and legal framework. Malaysia is one of the leading global hub for Islamic finance. (BNM, 2013). In Trade Arabia Business News (2014), Bahrain is the second most developed in Islamic finance sector after Malaysia. The infrastructure of Islamic finance in Bahrain is strong and needs to strive its efforts in promoting the kingdom as a hub for Islamic finance especially in Qatar and UAE.

According to Abdel Karim (2013), one of the major issues which were raised among developing nations and indeed all economies is how to improve their technical efficiencies. This has led to the adoption of various economic systems and policy options. The efficient performance of banks can help to compete and to achieve higher rate of return and at the same time to participate in economic development. In contrast, the inefficient performance of banks will lead to the hinder economic activities. Hence, the bank efficiency analysis is an important tool and the it provides a deep understanding of the importance of maintaining the efficiency of banking sector sustained economic development.

Nowadays, Islamic banks are facing a more diversified financial market and stiffer competition. There are quite a number of Islamic banks operating worldwide. In Malaysia alone to-date there are at least 16 Islamic banks. In order to be competitive, the Islamic banks must improve their efficiency and effectiveness to be on par with the world-class players. Despite the rapid growth in the Islamic banking industry, measuring efficiency levels at the Islamic banks is an important issue for managers and investors alike. Consumers also get benefit from efficient resource usage and allocation because this may mean lower prices and more profesional service.

In Islamic banking industry, most of banks were facing the similar problems to manage their resources which are inputs and outputs efficiently as well as conventional banks. This situation also occurred in Islamic banks in Malaysia and Bahrain in order to minimize the input and maximize the output. Due to this problem, Islamic banks in Malaysia and Bahrain should be strived to manage their

resources efficiently and reduce the level of inefficiencies or waste the resources. As an Islamic financial hub, Malaysia and Bahrain have to manage their input and output efficiently in order to maintain the performance from time to time. Therefore, the study attempts to fill the gaps in analyzing the level efficiency of Islamic banks in Malaysia and Bahrain as the leading's hub for Islamic finance. Indirectly, the results may examine which country performs better compared to the other.

1.5 Research Questions

In order to attain the problem statement the following research questions are formulated.

- a) To what extent the level efficiency of Islamic banks in Malaysia?
- b) To what extent the level efficiency of Islamic banks in Bahrain?
- c) What is the source of efficiency of Islamic banks in Malaysia and Bahrain?

1.6 Research Objectives

In general, the purpose of the study is to measure the level efficiency of Islamic banks between Malaysia and Bahrain using the Data Envelopment Analysis (DEA) model. Hence, the specific purposes of the study are as stated below:-

- a) To analyse the level efficiency of Islamic banks in Malaysia.
- b) To analyse the level efficiency of Islamic banks in Bahrain
- c) To examine the source of efficiency of Islamic banks in Malaysia and Bahrain.

1.7 Significance of the Study

The significance of this study would contribute to the efficiency, improvement and value of the output of the Islamic banking . At the same time, it will gives benefit to bank management, investors, regulators as well as research area.

a) Bank Management

The findings regarding efficiency level of Islamic banks will be beneficial to bank management itself. Managerial performance can be improved by identifying best practice and worst practice associated with high and low efficiency firms, respectively. In addition, frontier efficiency analysis can identify best practice banks and provide numerical efficiency scores and rankings which can be quite useful to policy makers, market analysts and managers of competing banks.

b) Investors and Regulators

This study will assists investors in making investment decisions whether to participate in financial activities. It is also vital to the regulators as they are also interested in the banking efficiency since the performance of the banking sector has significant impact on other parts of the economy. By measuring and comparing the efficiency between Islamic banks in Malaysia and Bahrain, the bankers are able to recognise the effectiveness of their system and approaches being implemented in those years as well as to improve on their cost controlling effort by wisely utilising their inputs in generating profits.

c) Research Area

The finding of this study will be used as references by expanding the scope of the existing knowledge on the field of study. Besides that, the study will be useful to academicians, practitioners and future researcher who may be interested in carrying out further research on the field of study. It also gives a good impact to students and it can be used as references. Indirectly, the students will get benefit and valuable knowledge from this study.

1.8 Scope and Limitation of the Study

The study focuses on the Islamic bank's efficiency in Malaysia and Bahrain for a selected period of 2008-2012. There are a few types of efficiency, but this study is limited to technical efficiency only. The study is also limited to Islamic banks in Malaysia and Bahrain mainly due to both countries are striving to be regional hubs for Islamic financial services (Ariss, 2010).

1.9 Organization of the Study

The study is organized in five chapter as follows, introduction in Chapter 1, Chapter 2 literature reviews on efficiency of Islamic banks . Next, Chapter 3 explains research methodology that is used and Chapter 4 provides results and discussions of the study. Finally, conclusion and recommendations are provided in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter provides a review of literature and it presents the relevant theoretical models and concept proposed in the study area. It consists of previous studies that are related to efficiency of banking industry.

2.2 Definition of Efficiency

Efficiency can be defined as the good usage of resources to maximize the production of the goods and services of the firms where it concerns with the relationship between the input resources such as labour costs, capital and equipment and the output produced using the inputs (Farrell, 1957). It means the organizations can use or manage their resources to produce goods and services very well.

According to Kumbhakar and Lovell (2003), the term efficiency refers to the use of resources to maximize the production of goods and services and it can be measured through three ways which are maximization of output, minimization of cost and maximization of profits. Meanwhile, Ahmad Mokhtar et al., (2006) defined efficiency as the comparison between the outputs and inputs used in the process of producing a product or services.

Efficiency can be used as an indicator to measure a bank's performance. Banking efficiency is defined as the difference between an observed quantity of input and output variables with respect to the optimal quantity of input and output variables. The bank efficiency can achieve a maximum value of one compared to inefficient bank can reduce to level of zero.

2.3 Measurement of Efficiency

The measurement of bank efficiency is mostly focused on two different approaches namely the parametric and non-parametric methods. The most commonly used parametric approaches are the Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA) and the Thick Frontier Approach (TFA). Whereas, the most commonly used non-parametric approach are the Data Envelopment Analysis (DEA) and Free Disposable Hull (FDH). (Berger & Humphrey, 1997).

The Stochastic Frontier Approach (SFA) is also known as the econometric frontier approach specifies a functional form for cost, profit or production relationship between inputs, outputs and environmental factors while allowing for random error. Similarly, the Distribution Free Approach (DFA) specifies a functional form but the random error of inefficiencies are separately in a different way. Meanwhile, the Thick Frontier Approach (TFA) also prescribes a functional form and assumes that deviations from predicted performance values within the highest and lowest quartiles of observations represents a random error.

For the non-parametric approach, the Data Envelopment Analysis or the mathematical programming approach constructs the frontier of the observed input-output ratios by linear programming techniques. It can be measured based on assumption of constant returns to scale or variable returns to scale. The Free Disposable Hull is a special case of a DEA model where it assumes that there is no substitution and the isoquant looks like a step function formed by the intersection of lines drawn from observed input combinations.

Besides measuring bank's efficiency, Data Envelopment Analysis has been extensively implored to evaluate the efficiency of hospital, (Che Razak, 2003; Al-Shayea, 2011), transportation industry (Tahir, 2011; Munisamy, 2009) insurance company (Md Saad & Idris, 2011) microfinance institutions (Kipesha, 2013) and others.

2.4 Efficiency of Islamic Banks

2.4.1 Efficiency of Islamic Banks in Malaysia

There are a quite significant number of studies carried out to investigate the level of efficiency in the Malaysian banking industry. For instance, studies by Ahmad Mokhtar et al., (2008); Kamaruddin et al., (2008) and Ab-Rahim et al., (2013) focused on both Islamic banks and conventional banks. Meanwhile, Fadzlan (2006,2007) focused only on the efficiency level between domestic and foreign Islamic banks in Malaysia.

In Malaysia, Samad (1999) was among the pioneer to examine the efficiency of the Islamic banking sector. In his study, he investigates the relative performance of the full-fledged Islamic bank compared to its conventional bank counterparts during the period of 1992 to 1996. The result indicates that the managerial efficiency of the conventional banks was higher than that of the full-fledged Islamic bank. Comparatively, analysis of efficiency between both samples found that Islamic banks tend to become inefficient when working side by side with conventional banking sector.

More recently, Sufian (2006) examined the efficiency of the Malaysian Islamic banking sector during the period 2001- 2004 by using the non-parametric Data Envelopment Analysis (DEA) method. From the study, the domestic Islamic banks have exhibited a higher technical efficiency compared to the foreign Islamic banks. During the period of study the foreign Islamic banks inefficiency were mainly due to scale rather than pure technical.

Ahmad Mokhtar et al., (2008) measured the factors that influence the efficiency of the full fledged Islamic banks and Islamic windows in Malaysia for the year 1997 to 2003. The study focused on the Technical Efficiency (TE) and cost efficiency. By using the DEA, the average technical efficiency and the cost efficiency score of the Islamic banks were lower than conventional banks. Meanwhile, the efficiency analysis based on the bank types showed that the full fledged Islamic banks were more efficient than the Islamic windows in both efficiency. However, the efficiency score was much lower compared to the conventional bank's score.

The results reported that the full fledged Islamic banks are more efficient than the Islamic windows and the Islamic windows of foreign banks tend to be more efficient than the domestic banks. The findings also revealed that the cost efficiency of Malaysian Islamic banks could be improved further. Similarly, Kamaruddin et al., (2008) discovered that the Islamic banks in Malaysia were relatively more efficient at controlling costs than at generating profits for the years 1998 to 2004.

By using similar method, Sufian (2007) examined the relative efficiency of Islamic banking sector in Malaysia which comprises into domestic and foreign banks over the period from 2001 till 2004. The domestic Islamic banks were more efficient compared to foreign Islamic banks. Generally, the source of inefficiency of Malaysian Islamic banks has been scale and it indicates that the industry have been operating at the wrong scale of operations.

According to Ab-Rahim et al., (2013) the study analyzed the efficiency performance of the full fledged Islamic banks in Malaysia for the period of 2006 to 2011. The study implements the DEA to measure the cost efficiency as well as the technical efficiency and its decompositions. The results showed that, on average the main contributor of cost efficiency for Islamic domestic and foreign banks in Malaysia is allocative efficiency. In addition, the result also indicated that Islamic foreign banks are more efficient than domestic banks with respect to pure technical efficiency and allocative efficiency.

Aik and Tan (2012) investigate the cost and profit efficiency of the full fledged Islamic banks and Islamic window operations of domestic and foreign banks in Malaysia over the period from 2002-2008 using Data Envelopment Analysis (DEA). Their study confirms Mokhtar et al., (2008) and Batchelor and Wadud (2004) findings that full-fledged Islamic banks are more efficient than Islamic window banks. Nevertheless, their results suggest that domestic Islamic banks are more efficient than foreign Islamic banks.

In another study, Zainal and Ismail (2012) measured the efficiencies of Islamic banks in Malaysia for the period of 2006 to 2010. The aims of the study were to calculate technical efficiency (TE), pure technical efficiency (PTE) and scale efficiency (SE) of Islamic banks, and to compare the efficiency scores between local and foreign Islamic banks. The results represent local Islamic banks achieved higher technical and scale efficiencies whereas foreign Islamic banks had higher pure technical efficiency score.

Ahmad et al., (2012) examined the relative efficiency of the Islamic commercial banks and conventional commercial banks in Malaysia over the period of 2003 to 2007. This study found that the conventional commercial banks (CCBs) outperformed Islamic commercial banks (ICBs) in all efficiency measures. The finding indicates that the CCBs may be more efficient than ICBs due to managerial efficiency and technological advancement.

Next, Ab-Rahim et al., (2013) investigated the efficiency performance of the full-fledged Islamic banks in Malaysia during the study period from 2006 to 2011 by using a similar approach, Data Envelopment Analysis. Based on the findings, it showed that on average the main contributor of cost efficiency for Islamic domestic and foreign banks in Malaysia is allocative efficiency. Islamic foreign banks are more efficient than domestic banks with respect to pure technical efficiency and allocative efficiency.

2.4.2 Efficiency of Islamic banks in Bahrain

In Bahrain, Samad (2004) analyzed the performance of the Islamic banks compared to Western banks which contained six Islamic and 15 Western banks from 1991 till 2001. The study examined income statements and balance sheets for these banks by using a set of financial ratios to measure the profitability, liquidity and to credit risk performance respectively. The result of the study showed there were no significant differences between the Islamic and Western banking systems in Bahrain when it come to profitability and deposit risk. However, the Islamic banks had higher equity ratios and lower liquidity risk compared to Western banks.

Jarrah (2007) stated that the Data Envelopment Analysis approach is used to investigate the cost efficiency levels of banks operating in Jordan, Egypt, Saudi Arabia and Bahrain over 1992 to 2000. The estimated cost efficiency is further decomposed into technical and allocative efficiency at both variable and constant return to scale. Later on, the technical efficiency is divided into pure technical and scale efficiency. Cost efficiency scores ranged from 50 % to 70 % with some variations in scores depending on bank's size and its geographical locations. The results suggested that the same level of output could be produced with approximately 50 % to 70 of their current inputs if banks under study were operating on the most efficient frontier.

2.4.3 Efficiency of Islamic banks in some other countries

Besides Malaysia and Bahrain, there are a lot of studies that related to bank's efficiencies from other countries. A bigger study was done by Yudistira (2004) whereby he evaluated the technical and scale efficiency with a global sample of 18 Islamic banks in Gulf Cooperation Countries (GCC), East Asian, Africa and Middle East over three years from 1997 to 2000. The findings of the study showed that Islamic banks to be more efficient than conventional banks. In contrast, Hassan (2006) in a larger study of 43 Islamic banks found somewhat less cost efficient than conventional banks. Similarly, Ahmad Mokhtar et al., (2006) in a study of Malaysian Islamic banks found that while Islamic banks had grown faster, their overall efficiency was lower than the conventional banks.

Hassan and Hussein (2003) examined the efficiency of the Sudanese banking system during the period of 1992 and 2000. The study employed a variety of parametric (cost and profit efficiencies) and non-parametric DEA techniques to a panel of 17 Sudanese banks. They found that the average cost and profit efficiencies under parametric were 55% and 50% respectively, while it was 23% under the non-parametric approach. During the period of study, the Sudanese banking system have exhibited 37% allocative efficiency and 60% technical efficiency suggesting that the overall cost inefficiency of the Sudanese Islamic banks were mainly due to technical(managerial) rather than allocative (regulatory).

In another study, Sufian et al., (2009) performs an analysis on the efficiency of Islamic banks using empirical evidence from the MENA (Middle East and North Africa) and Asian countries. The results showed that the MENA Islamic banks have exhibited higher mean technical efficiency relative to their Asian Islamic banks counterparts with pure technical inefficiency outweighs scale inefficiency in both the MENA and Asian countries banking sectors. The findings also indicated that banks from the MENA region were the most efficient banks by dominating the top part of efficiency frontier over the period.

Mohammad Noor et al., (2011) measured the efficiency of the Islamic banking sectors in 4 Asian countries namely Bangladesh, Indonesia, Malaysia and Pakistan during the period of 2001 to 2006. The efficiency estimates of individual banks are evaluated by using the non-parametric DEA method. The results imply that during the period of study, although the Asian Islamic banking sector have been operating at a relatively optimal scale of operations, relatively managerial inefficiency in controlling their operating costs and utilizing the resources to the fullest. The finding also showed that the banks from Indonesia were the most efficient from the Asian region, followed by banks from Pakistan and Bangladesh and the Malaysian Islamic banking sector were the least efficient.

Al-Kathlan and Malik (2012) studied the efficiency of Saudi Banks by using Data Envelopment Analysis (DEA) models like Charnes Cooper Rhodes (CCR) and Banker Charnes Cooper (BCR). The paper covered 10 out of 12 operating banks in Saudi industry from 2003 to 2008. The empirical results showed that most of Saudi banks do have efficient financial resources by 86.17% and 93.97% as per CCR and BCR approach respectively.

Meanwhile, Khaddaj (2010) investigated the level of efficiency of the Syrian private banks during the period 2006 to 2009. A total of 10 banks were evaluated by using four models to analyze the relative efficiency of each bank based on its operating and intermediation levels. The findings revealed that in spite of the fact that most Syrian banks were inefficient on their operating level, but they tend to be more efficient in their intermediation role. Accordingly, the Syrian banks could further utilize their resources to generate more revenues and / or reduce their expenses in order to reach the efficiency frontier.

Ahmad et al., (2011) examines the efficiency of the Islamic banking sectors in the world covering 25 countries during the period 2003 to 2009. The efficiency estimates of individual banks are evaluated using the non-parametric DEA method. The empirical findings suggest that during the period of study, pure technical efficiency outweighs scale efficiency in World Islamic banking countries. Based on the findings, it indicates that banks from the high income countries were the leaders by dominating the most efficiency frontier during the period of study.

In Jordan, Ajlouni et al., (2011) measured the relative efficiency of banks and they also investigated the determinants of such inefficiency in terms of bank size and capitalization. The duration of the measured performance of their study was is 2005 to 2008. The results of their study indicate that average efficiency score of the sample banks are high and stable over time. Another important result was that the relative efficiency of larger banks significantly outperforms smaller and medium size banks, indicating that bank size is a determinant of efficiency. However, banks with a higher capital adequacy ratio were less efficient. It concluded that commercial banks in Jordan with a higher capital adequacy ratio are risk adverse and managing safer and lower earning portfolios.

For other studies in Jordan, Zeitun et al., (2013) measured and evaluated the relative efficiency of 12 Jordanian banks over the period 2005 to 2010. In this study, constant return to scale (CRS) and variable return to scale (VRS) were used in order to measure the relative efficiency. The result of the study showed that, on the technical efficiency scale only a few Jordanian banks were efficient in managing their financial resources and generating profit. Furthermore, few banks were found to be efficient on the scale of pure technical efficiency in a few years. Moreover, there is a significant impact on bank's efficiency due to the financial crisis.

According to Said (2013), the paper measured overall technical efficiency of Islamic banks operating in the MENA region during the financial crisis of 2007-2009. Similar to other studies, the study used non-parametric technique DEA to examine OTE, PTE as well as SE. The results show Islamic bank in other MENA countries and North Africa on an average are relatively technical inefficient due to the underdeveloped banking system in those countries. In addition, the decomposition of technical efficiency into pure technical efficiency and scale efficiency shows that on average, the Islamic banks in North Africa countries and other MENA countries are having problems in the allocation of resources between their input and outputs compared to Islamic banks in GCC.

2.5 Conclusion

In this section, it reviews the concept of efficiency and the approaches used in order to measure the level of efficiency either parametric methods or non-parametric methods. Other than that, it shows the previous studies on banking efficiency, especially in the Islamic banking industry by using Data Envelopment Analysis (DEA). From this section, it can determine the approach used by the authors and the selection of input and output for their studies. The next chapter is research methodology.

Table 2.1
Summary of Past Studies

AUTHORS	METHOD	COUNTRY	YEAR	INPUT	OUTPUT	FINDINGS
Donsyah Yudistira	Data Envelopment Analysis		2004	1) Staff Costs 2) Fixed Assets 3) Total Deposits	1) Total Loans 2) Other Income 3) Liquid Asset	Islamic banks in the sample suffered from the global crisis in 1998-1999 but performed very well after the difficulties periods. The findings of the study showed that Islamic banks to be more efficient than conventional banks
Fadzlan Sufian	Data Envelopment Analysis	Malaysia	2006	1) Total Deposits 2) Total Assets 3) Labour	1) Total Loans 2) Income	The results show scale efficiency outweighs pure technical efficiency in the Malaysian Islamic banking sector, implying that Islamic banks have been operating at non-optimal of operations. Domestic Islamic banks have a higher technical efficiency compared to foreign Islamic banks. The foreign Islamic banks inefficiency were mainly due to scale rather pure technical.
Fadzlan Sufian	Data Envelopment Analysis	Malaysia	2007	1) Total Deposits 2) Labour 3) Fixed Assets	1) Total Loans 2) Income	The results from the DEA suggest that Malaysian Islamic banks efficiency declined in year 2002 to recover slightly in years 2003 and 2004. The domestic Islamic banks were more efficient compared to the foreign Islamic banks albeit marginally. The source of inefficiency of Malaysian Islamic banks in general has been scale, suggesting that Malaysian Islamic banks have been operating at the wrong scale of operations.

Hamin S. Ahmad Mokhtar, Naziruddin Abdullah and Syed M Alhabshi	Data Envelopment Analysis	Malaysia	2008	1) Total Deposit 2) Total Overhead Expenses (personnel exp. + other operating exp.)	1) Total Earning Assets	On average, the efficiency of the overall Islamic banking industry has increased during the period of study. The full-fledged Islamic banks were more efficient than the Islamic windows but still less efficient than the conventional banks. Islamic windows of foreign banks were found to be more efficient than Islamic windows of domestic banks
Badrul Hisham Kamaruddin, Mohammad Samaun Safa and Rohani Mohd	Data Envelopment Analysis	Malaysia	2008	1) Personnel Expenses 2) Total Deposits 3) Fixed Asset	1) Earning Assets 2) Liquid Assets 3) Other Income	Islamic banking operators are relatively more efficient at controlling costs than at generating profits. The main contributor for cost efficiency of domestic and foreign banks comes from resource management and economies of scale respectively.
Fadzlan Sufian, A.M Noor Mohamad and Abdul Majed Muhammed Zulkhibri	Data Envelopment Analysis	MENA and Asian Countries	2009	1) Total Deposits 2) Assets	1) Total Loan 2) Income 3) Investments	The results found the MENA Islamic banks have exhibited higher mean technical efficiency compared to Asian Islamic banks with pure technical inefficiency outweighs scale inefficiency in both the MENA and Asian countries banking sectors.
Mohamad Akbar Noor Mohamad Noor , Nor Hayati Ahmad and Fadzlan Sufian	Data Envelopment Analysis	4 Asian countries Bangladesh, Indonesia, Malaysia and Pakistan	2011	1) Total Deposits 2) Assets	1) Total Loans 2) Income 3) Investment	The results imply that during the period of study, although the Asian Islamic banking sectors have been operating at a relatively optimal scale of operations, the bank relatively managerially inefficiency in controlling the operating costs and utilizing the full resources.

Nor Hayati Ahmad, Mohamad Akber Noor Mohamad Noor and Fadzlan Sufian	Data Envelopment Analysis	25 Countries	2011	1) Total Deposits 2) Labor Costs 3) Total Assets	1) Total Loans 2) Income 3) Other Earning Assets	The empirical findings show that during 2003-2009, pure technical efficiency outweighs scale efficiency in World Islamic banking countries. It indicates the high income countries were the leaders by dominating the most efficiency frontier.
Noor Saliza Zainal and Mahadzir Ismail	Data Envelopment Analysis	Malaysia	2012	1) Total Deposits 2) Personnel Expenses 3) Fixed Assets	1) Financing and Advances 2) Other Earning Asset	The average TE, PTE and SE were 0.79, 0.90 and 0.88 respectively. The local Islamic banks scored higher TE and SE compared to foreign Islamic banks. But foreign Islamic banks scored higher PTE than that of Islamic banks.
Suraya Ahmad and Abdul Rahim Abdul Rahman	Data Envelopment Analysis	Malaysia	2012	1) Labour 2) Capital 3) Total Deposits	1) Loans and Advances 2) Total Income	This study found that the conventional commercial banks (CCBs) outperformed Islamic commercial banks (ICBs) in all efficiency measures. The finding indicates that the CCBs may be more efficient than ICBs due to managerial efficiency and technological advancement.
Farhana Ismail, M.Shabri Abd.Majid and Rossazana Ab.Rahim	Data Envelopment Analysis	Malaysia	2013	1) Labour 2) Capital 3) Total Deposits	1) Total Loans 2) Other Earning Assets 3) Off-Balance Sheet Items	Technical efficiency as the main contributor of cost efficiency for conventional commercial banks and allocative efficiency as the main contributor for Islamic commercial banks. Scale efficiency is found to be the main source of technical efficiency for both Islamic and conventional commercial banks.

Rossazana Ab-Rahim, Norlida Kadri and Farhana Ismail	Data Envelopment Analysis	Malaysia	2013	<ol style="list-style-type: none"> 1) Personel Expenses 2) Fixed Asset 3) Total Deposit 	<ol style="list-style-type: none"> 1) Total Loans 2) Securities Portfolios 3) Off balance sheet items 	The results show that, on average the main contributor of cost efficiency for Islamic domestic and foreign banks in Malaysia is allocative efficiency. Islamic foreign banks are more efficient than domestic banks with respect to pure technical efficiency and allocative efficiency.
Ali Said	Data Envelopment Analysis	MENA countries	2013	<ol style="list-style-type: none"> 1) Labor Cost 2) Fixed Asset 3) Total Deposits 	<ol style="list-style-type: none"> 1) Total Loan 2) Liquid Assets 3) Other Income 	Islamic bank in other MENA countries and North Africa on an average are relatively technical inefficient. In addition, the decomposition of technical efficiency into pure technical efficiency and scale efficiency shows that on average, the Islamic banks in North Africa countries and other MENA countries are having problems in the allocation of resources.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodology employed so as to meet the objectives of the research, which is to measure the efficiency of the Islamic banking sectors in Malaysia and Bahrain. The structure of this chapter is comprised into research design in terms of data collection, source of data and data analysis. The study utilizes Data Envelopment Analysis and parametric test and non-parametric test to compare the level of efficiency between Malaysia and Bahrain.

3.2 Research Design

3.2.1 Data Collection

The study analyzed the efficiency level of 31 Islamic banks from Malaysia and Bahrain due to the availability of data. The duration of study was from year 2008 to 2012. Specifically, 15 Islamic banks in Malaysia were examined in 2008, 2010, 2011, 2012 and 16 Islamic banks in 2009. Meanwhile, 12 Islamic banks in Bahrain were examined in 2008,2009, 2010 and 11 Islamic banks in 2011,2012. All data is in millions of US Dollar (USD). The number of sample banks by country included in the study is as Table 3.1 below.

3.2.2 Source of Data

The data for this study were extracted from Islamic bank's annual report and from the Bankscope Database . But due to incomplete and unavailability of data provided by these sources, not all Islamic banks were analyzed during the period of study. In other words, the total number of Islamic banks analyzed per year were different throughout the period. A non-parametric Data Envelopment Analysis (DEA) is employed with variable returns to scale (VRS) assumption to measure technical efficiency of Islamic banks between Malaysia and Bahrain.

Table 3.1
Number of Sample Islamic Banks by Country (2008-2012)

Year	Country	No. of Islamic Banks
2008	Malaysia	15
	Bahrain	12
	Total	27
2009	Malaysia	16
	Bahrain	12
	Total	28
2010	Malaysia	15
	Bahrain	12
	Total	27
2011	Malaysia	15
	Bahrain	11
	Total	26
2012	Malaysia	15
	Bahrain	11
	Total	26
TOTAL OVERALL		134

3.2.3 Data Analysis

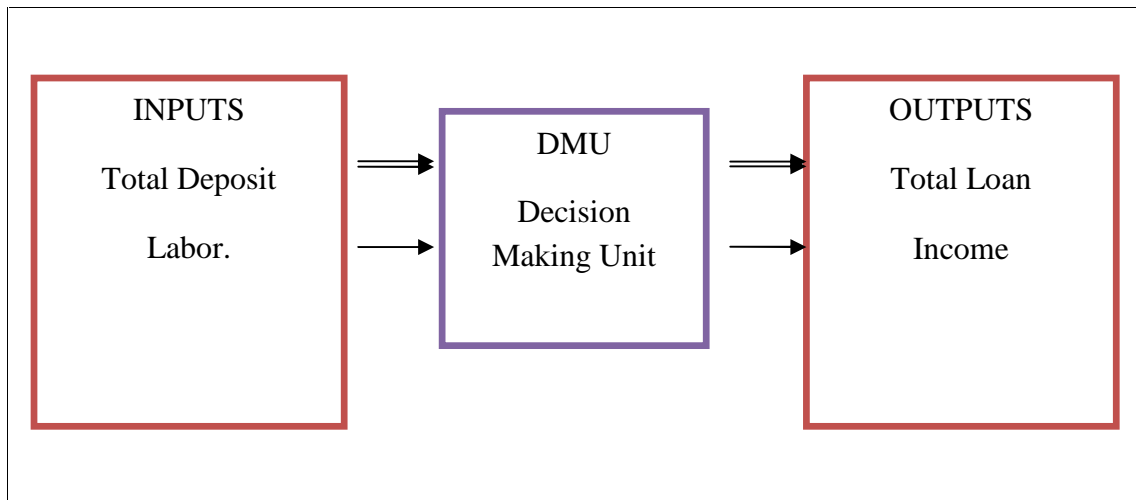
3.2.3.1 Data Envelopment Analysis

Two main approaches have been used to estimate banks efficiency which are parametric and non-parametric approaches (Berger and Humphrey, 1997). The difference between both approaches is that parametric approach requires a specification of functional form of production, cost and profit in addition to assumption about error whereas non-parametric approach don't requires a prior assumption about error or specification of functional form for production. Data Envelopment Analysis (DEA) has been used extensively to evaluate the efficiency of banking institutions.

DEA was first introduced by Farrell (1957). It is a linear programming for frontier analysis of multiple inputs and multiple outputs. DEA compares each producer unit with the optimal producer unit to find out the inefficiency level of each producer. This producer unit known as Decision Making Unit (DMU). Here, each of DMU has a function of converting a set of inputs into a set of outputs.

The main objective of DEA is to determine which banks are operating on their efficient frontier and which banks are not. If the bank's input-output combination lies on the DEA frontier, the bank is considered efficient and the bank is considered inefficient if the bank's input-output combination lies inside the frontier. Figure 3.1 illustrates the DEA process for this study.

Figure 3.1
DEA Process



DEA can estimate efficiency under the assumption of constant returns to scale (CRS) and variable returns to scale (VRS). The CCR model proposed by Charnes, Cooper and Rhodes (1978) is assumed CRS and only appropriate when all DMUs are operating at optimal scale. However, factors like imperfect competition and constraints in finance may cause banks not to operate at optimal scale. The efficiency measures attained from CCR model are known as overall technical efficiency (OTE) scores and are confounded by scale efficiencies.

As a result, the established bank literature that uses linear programming techniques to estimate efficiency tend to use the VRS assumption as suggested by Banker, Charnes and Cooper (1984). The BCC model extended the CCR model with the purpose of resolving problems with VRS. The efficiency measures acquired from BCC model are indentified as pure technical efficiency (PTE) scores and without of scale efficiency (SE) effects. It can have SE for each DMU by a ratio of OTE scores to PTE scores.

The input oriented DEA model with VRS technologies can be represented the following linear programming problem:

$$\begin{aligned}
 & \min \theta, \\
 & \text{subject to } -y_i + Y\lambda, \geq 0 \\
 & \quad xi - X\lambda \geq 0 \\
 & \quad N1' = 1 \\
 & \quad \text{and } \theta \geq 0
 \end{aligned} \tag{1}$$

where θ is an $N \times 1$ intensity vector of constants and λ is a scalar ($\lambda \geq 0$). $N1'$ is an $N \times 1$ vector of ones. For N number of firms, y_i and xi are the $M \times N$ and $K \times N$ output and input vectors, respectively. Y comprises the data for all N firms. Given a fixed level of inputs for the i th firm. Note that without the convexity constraint $N1' = 1$, equation (1) becomes a DEA model with CRS technology. The convexity constraint implies that an inefficient firm is benchmarked against firms of a similar size and therefore the projected point of that firm on the DEA frontier will be a convex combination of observed firms. In other words, each firm would produce on or to the right of the convex production possibility frontier.

If TE scores for a particular firm with or without the convexity constraint imposed are the same, then the firm is operating under CRS. If these scores are different, the firm operate under VRS technology. However, in such a case, it would be necessary to identify whether the firm or the DMU operates with IRS or DRS. To do this, assumption of non-increasing returns to scale (NIRS) is imposed in (1) and the convexity constraint $N1' = 1$ is substituted with $N1' \leq 1$. This is given as follows:

$$\begin{aligned}
& \min \theta, \\
\text{subject to } & -y_i + Y_j \theta \geq 0 \\
& x_i - X_j \theta \leq 0 \\
& N_j' \theta = 1 \\
& \text{and } \theta \geq 0
\end{aligned} \tag{2}$$

Solution of the equation (2) reveals the nature of scale efficiencies. IRS exists if TE score obtained with NIRS technology differs from the TE estimates with VRS technology. If both of these efficiency scores are equal, then the corresponding firm operates with DRS.

To measure the efficiency of Islamic banks in Malaysia and Bahrain in this study, the Data Envelopment Analysis will be used in this research for the following reasons:

- 1) It has been used by several researchers.
- 2) It does not require specifying the functional form or distributional forms for errors.
- 3) According to Hassan (2013), DEA is a more robust approach for efficiency assessment as it measures the relative efficiency of each production unit with regard to the efficient frontier that is constructed from the actual data.
- 4) The principle of Islamic financial system is based on participation in enterprise or equity-based where the business participants may end up with profit or loss. This, by no means implies the importance of intermediary activities.

The advantages of using DEA to measure efficiency is that DEA allows calculating parameters such as overall technical efficiency. It also helps in understanding and computing the pure technical and scale efficiencies. According to Farrell (1957), technical efficiency (TE) can be defined as the firm's ability to obtain as large as possible an output from a combination of inputs. Scale efficiency (SE) refers to the firm's ability to work at its optimal scale while pure technical efficiency (PTE) refers to the firm's ability to avoid waste by producing as much output as input usage allows or by using as little input as output production allows.

The weakness of DEA is that it assumes data are free from measurement errors. Furthermore, since efficiency is measured in a relative way, its analysis is confined to the sample set used. This means that an efficient DMU found in the analysis cannot be compared with other DMUs outside of the sample.

3.2.3.2 Identification of Inputs and Outputs

There are three approaches in defining input and output which are intermediation approach, the production approach and the value added approach. In the intermediation approach, bank is assumed as a financial institution that plays a role of intermediation between customers who deposit money in the bank and customers who need to take money or loan from the bank (Ahmadanuar et al., 2014).

In the production approach, bank is defined as a financial institution that produces some services for its customers such as depositors and account holders. Meanwhile, value added approach or operating approach is where the bank is assumed as a business unit that its main target is generating revenue from the total cost for running the business (Ahmadanuar et al., 2014).

Therefore, this study adopts the intermediation approach due to several reasons. Firstly, the intermediation approach is appropriate for evaluating the overall bank's efficiency. Secondly, this approach has been used extensively in determining the inputs and outputs of the bank industry by several researchers. Thirdly, the participation based approach of Islamic banking is an appropriate perspective for intermediation approach and for the intermediary role of the Islamic banking function.

This study selects two inputs and two outputs to be analysed which are total deposit and labor as an input while total loan and income as an input. Table 3.2 below shows summary of inputs and outputs used in the previous studies that related to bank's efficiency.

Table 3.2
Summary of input and output used in the previous studies

Authors	Year	Approach	Inputs	Outputs
Fadzlan Sufian	2006	Intermediation	Total Deposits, Total Assets, Labor	Total Loans, Income
Fadzlan Sufian	2007	Intermediation	Total Deposits, Labor, Fixed Assets	Total Loans, Income
Hamim S Ahmad Mokhtar Naziruddin Abdullah and Syed M Alhabshi	2008	Intermediation	Total Deposit, Total Overhead Expenses	Total Earning Assets
Fadzlan Sufian	2008	Intermediation	Deposits, Labor, Capital	Loans, Investments
		Value added	Labor, Capital, Interest Expenses	Deposits, Loans, Investments
		Operating	Interest Expenses, Labor, Non- Interest Expense	Interest Income, Non-Interest Income
Mohamed M. Mostafa	2009	Operating	Asset Equity	Net Income, Rate on Assets, Rate on Equity
Norma Md. Saad	2010	Operating	Portfolio Turnover Ratio, Management Expenses Ratio	Returns
Mohammad Hanif Akhtar	2010	Operating	Interest, Non- Interest Expenses	Net Interest Income, Non- Interest Income
Noor Saliza Zainal and Mahadzir Ismail	2012	Intermediation	Total Deposits, Personnel Expenses, Fixed Assets	Financing and Advances, Other Earning Asset

Table 3.3
The outputs and inputs used in the Study

INPUT	OUTPUT
Total Deposit	Total Loan
Labor (Personnel Expenses)	Income

Table 3.3 above represents the selection of inputs and outputs for this study. The inputs are total deposit and labor whereas the outputs are total loan and income. The definition of each term is described below.

- **Inputs**

- i) Total Deposit

The deposit is a liability owed by the bank to the depositor (the person or entity that made the deposit), and refers to this liability rather than to the actual funds that are deposited. Total deposits include current, saving and investment deposits from customers, banks and other financial institutions (Alkheil, 2012).

- ii) Labor

Labor refers to all human physical and mental effort used in creation of goods and services. In this study, labor measured by personnel expenses of staff costs. Total staff costs include wages, salaries, allowances, bonuses and other staff related costs.

- **Outputs**

- i) Total Loan

Total loan refers to a written or oral agreement for a temporary transfer property from the lender to a borrower who promises to return it according the terms of the agreement. In the context of Islamic banking, total loans include financing to customer's banks and other financial institutions that structured under *Murabaha Ijarah* rental, *Mudaraba*, *Istisna*, *Musharaka* and others (Alkheil, 2012).

- ii) Income

Income refer to an individual or business receives in exchange for providing goods or services. In business, income can refer to a company's remaining revenues after all expenses and taxes have been paid. It also include income from investment of depositor's, shareholder's funds and others in the form of *Murabaha*, *Musharaka*, income from investment in *Sukuk*, income from Islamic financing assets and placement, management and arrangement fees, income from international *Murabaha*, commission, fees and foreign exchange, property related to unrestricted investment accounts and others.

3.3 Independent Sample T-Test

The study adopts the DEA that is commonly used in the study of bank's efficiency. Meanwhile, in order to compare the level of efficiency of the Islamic banks in Malaysia and Bahrain, the study used the independent sample *t*-test and Mann-Whitney *U*-test to compare between the two different groups. The study uses the SPSS to analyse the differences between the mean efficiency score of Islamic banks between Malaysia and Bahrain.

3.4 Conclusion

This chapter review the details of methodology used in this study in terms of measurement of approach, identification of outputs and inputs, data collection methods, sampling and data analysis techniques. The next chapter is data analysis of efficiency in Islamic bank between Malaysia and Bahrain.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

In this chapter, the Data Envelopment Analysis (DEA) technique is used in the analysis of the efficiency for the selected period from 2008 to 2012. The study utilized the output-input data for Islamic banks in Malaysia and Bahrain which comprises of 16 Islamic banks in Malaysia and 15 Islamic banks in Bahrain. Total loans and income are selected as output while total deposits and labor are selected as input. The result of the analysis as follows.

4.2 Descriptive Statistics of Inputs and Outputs

Data are expressed in descriptive statistics obtained from Bankscope Database and bank's annual report. All variables are measured in millions of United State Dollars (USD). In this study, two inputs and two outputs has been selected in order to examine the efficiency of Islamic banks in Malaysia and Bahrain during the study period from 2008 to 2012. Accordingly, Total Deposits (x1) which derived of deposits from customers and other banks and Labor (x2) were used as inputs whereas Total Loan (y1) consisted of loans, advances and financing and Income (y2) were used as outputs in this study. Table 4.1 and Table 4.2 below show the descriptive statistics of inputs and outputs for Islamic banking in Malaysia and Bahrain respectively.

Table 4.1
Descriptive Statistics of Inputs and Outputs in Malaysia

Year	Outputs	Mean	Min	Max	Std.Dev.
2008	Total Loan (y1)	6 902 170	418 912	76 500 514	19 324 761.71
	Income (y2)	1 245 125	5 282	16 911 798	4 335 240.20
2009	Total Loan (y1)	16 992 739	585 256	206 280 407	54 526 989.87
	Income (y2)	1 558 119	61 767	20 569 912	5 261 351.07
2010	Total Loan (y1)	17 260 367	717 195	220 788 507	56 371 129.47
	Income (y2)	1 754 955	65 914	266 398 498	68 730 033.39
2011	Total Loan (y1)	22 277 629	883 873	286 768 776	73 259 846.12
	Income (y2)	2 236 970	82 785	30 380 907	7 787 188.40
2012	Total Loan (y1)	34 181 955	1 205 473	453 376 163	116 051 452.10
	Income (y2)	2 590 119	102 436	34 439 630	8 814 953.16
Year	Inputs	Mean	Min	Max	Std.Dev.
2008	Total Deposit (x1)	33 111 821	550 831	457 098 690	117 308 839.50
	Labor (x2)	400 412	188	5 836 707	1 504 015.57
2009	Total Deposit (x1)	38 553 201	825 380	529 929 020	135 960 111.90
	Labor (x2)	404 067	457	5 855 788	1 508 278.17
2010	Total Deposit (x1)	41 084 314	1 045 402	562 616 120	144 309 946.60
	Labor (x2)	577 970	1,107	8 371 341	2 156 214.47
2011	Total Deposit (x1)	44 678 588	1 547 523	597 200 423	152 930 525.6
	Labor (x2)	508,389	2,063	7 338 798	1 889 748.87
2012	Total Deposit (x1)	53 267 026	1 788 111	713 316 551	182 697 796.30
	Labor (x2)	545 406	2 512	7 848 270	2 020 485.30

Table 4.1 above represents descriptive statistics of output and input variables from Islamic banks in Malaysia. Over the five year period, it indicates that the awareness of Islamic banking and finance products among Malaysian has been increased due to the growth in total loans as well as total deposits from 2008 to 2012. Similarly , the total income also increased year by year.

Table 4.2
Descriptive Statistics of Inputs and Outputs in Bahrain

Year	Outputs	Mean	Min	Max	Std.Dev.
2008	Total Loan (y1)	8 187 895	288	79 230 283	22 517 947.60
	Income (y2)	2 764 109.08	235	18 230 331	6 136 099.45
2009	Total Loan (y1)	17 847 409	16 133	119 032 474	40 374 799.85
	Income (y2)	2 311 474.67	216	13 681 471	5 302 876.85
2010	Total Loan (y1)	12 697 376	17 458	145 097 545	41 708 751.68
	Income (y2)	1 157 741.75	248	13 453 771	3 872 608.62
2011	Total Loan (y1)	21 512 246	15 799	228 684 187	68 723 922.33
	Income (y2)	2 029 531.50	291	19 856 511	6 264 113.99
2012	Total Loan (y1)	23 305 191	17 171	249 217 259	74 939 294.75
	Income (y2)	1 958 637.09	279	21 124 536	6 357 046.71

Year	Inputs	Mean	Min	Max	Std.Dev.
2008	Total Deposit (x1)	19 923 393	5 720	192 775 593	55 414 954.63
	Labor (x2)	13 629 213.58	607	131 888 081	38 115 139.56
2009	Total Deposit (x1)	4 872 347	10 949	37 705 222	11 081 653.96
	Labor (x2)	5 650 081	641	42 382 205	13 479 322.49
2010	Total Deposit (x1)	7 453 136	12 186	81 330 311	23 279 690.87
	Labor (x2)	3 303 053.08	719	38 353 602	11 039 623.50
2011	Total Deposit (x1)	8 712 354	11 985	88 760 342	26 561 940.33
	Labor (x2)	4 045 699.4	818	43 179 110	12 980 837.92
2012	Total Deposit (x1)	9 179 570	7 716	97 612 051	29 332 655.75
	Labor (x2)	3 835 840.72	816	40 931 191	12 305 753.69

The descriptive statistics of output and input variables from Islamic banks in Bahrain is shown in Table 4.2. During the study period, total loans show increasing trend in year 2009, 2011 and 2012 compared the other year. The same goes to total deposits which show fluctuation from 2008 to 2010 and increase again for the last two years.

4.3 Efficiency of Islamic banks in Malaysia (2008-2012)

4.3.1 Efficiency of Islamic banks in Malaysia (2008)

Table 4.3
Efficiency of Islamic banks in Malaysia (2008)

DMU	OTE	PTE	SE
Affin Islamic Bank Berhad	1.000	1.000	1.000
Al-Rajhi Banking and Investment Corporation (Malaysia) Berhad	0.678	1.000	0.678
Alliance Islamic Bank Berhad	1.000	1.000	1.000
Am Islamic Bank Berhad	0.133	1.000	0.133
Asian Finance Bank Berhad	0.350	1.000	0.350
Bank Islam Malaysia Berhad	0.093	0.317	0.292
Bank Muamalat Malaysia Berhad	0.171	0.723	0.237
Hong Leong Islamic Bank Berhad	0.194	0.393	0.493
HSBC Amanah Malaysia Berhad	0.684	1.000	0.684
Kuwait Finance House (Malaysia) Berhad	0.216	1.000	0.216
Maybank Islamic Bank Berhad	0.383	1.000	0.383
OCBC Al Amin Bank Berhad	1.000	1.000	1.000
Public Islamic Bank Berhad	1.000	1.000	1.000
RHB Islamic Bank Berhad	0.127	0.320	0.397
Standard Chartered Saadiq Berhad	1.000	1.000	1.000
MEAN	0.535	0.850	0.591

Notes: DMU- Decision Making Unit OTE- Overall Technical Efficiency
PTE- Pure Technical Efficiency SE- Scale Efficiency

Table 4.3 above shows the Overall Technical Efficiency (OTE), Pure Technical Efficiency (PTE) and Scale Efficiency (SE) level of the Islamic banks for the year 2008 which are 53.5%, 85% and 59.1% respectively. The overall technical inefficiency of the Islamic banks in Malaysia is due to the scale inefficiency, suggesting that Islamic banks have been operating at the wrong scale of operations. In 2008, it is found that Affin Islamic Bank Berhad, Alliance Islamic Bank Berhad, OCBC Al-Amin Bank Berhad, Public Islamic Bank Berhad and Standard Chartered Saadiq Berhad are the efficient banks in 2008. On the other hand, Bank Islam Malaysia Berhad scores the lowest efficiency level under OTE which is 9.3% .

4.3.2 Efficiency of Islamic banks in Malaysia (2009)

Table 4.4
Efficiency of Islamic banks in Malaysia (2009)

DMU	OTE	PTE	SE
Affin Islamic Bank Berhad	1.000	1.000	1.000
Al-Rajhi Banking and Investment Corporation (Malaysia) Berhad	0.526	1.000	0.526
Alliance Islamic Bank Berhad	1.000	1.000	1.000
Am Islamic Bank Berhad	1.000	1.000	1.000
Asian Finance Bank Berhad	1.000	1.000	1.000
Bank Islam Malaysia Berhad	0.671	1.000	0.671
Bank Muamalat Malaysia Berhad	0.017	0.366	0.046
CIMB Islamic Bank Berhad	0.052	0.239	0.217
Hong Leong Islamic Bank Berhad	0.387	0.679	0.571
HSBC Amanah Malaysia Berhad	1.000	1.000	1.000
Kuwait Finance House (Malaysia) Berhad	0.229	0.403	0.569
Maybank Islamic Bank Berhad	0.110	0.223	0.494
OCBC Al Amin Bank Berhad	0.066	0.312	0.212
Public Islamic Bank Berhad	0.325	0.344	0.944
RHB Islamic Bank Berhad	0.817	1.000	0.817
Standard Chartered Saadiq Berhad	0.889	0.903	0.984
MEAN	0.568	0.717	0.691

Based on Table 4.4 above, the mean of OTE of Islamic banks in 2009 is 56.8%. In terms of PTE, it indicates that the efficiency of Islamic banks are 71.7% whereas the scale efficiency scores is 69.1%. This result recommends that the Islamic banks could have saved 43.2% of the inputs to produce the same amount of outputs that they produced. This indicates that in 2009, the overall technical inefficiency is also due to scale inefficiency. In 2009, there are 5 Islamic banks are efficient which are Affin Islamic Bank Berhad, Alliance Islamic Bank Berhad, Am Islamic Bank Berhad, Asian Finance Bank Berhad and HSBC Amanah Malaysia Berhad. In contrast, Bank Muamalat Malaysia Berhad is the least efficient bank in 2009.

4.3.3 Efficiency of Islamic banks in Malaysia (2010)

Table 4.5
Efficiency of Islamic banks in Malaysia (2010)

DMU	OTE	PTE	SE
Affin Islamic Bank Berhad	0.156	0.893	0.175
Al-Rajhi Banking and Investment Corporation (Malaysia) Berhad	0.365	0.832	0.438
Alliance Islamic Bank Berhad	0.076	1.000	0.076
Am Islamic Bank Berhad	0.647	1.000	0.647
Asian Finance Bank Berhad	1.000	1.000	1.000
Bank Islam Malaysia Berhad	0.527	0.544	0.968
Bank Muamalat Malaysia Berhad	0.036	0.753	0.048
Hong Leong Islamic Bank Berhad	0.442	1.000	0.442
HSBC Amanah Malaysia Berhad	0.556	0.882	0.630
Kuwait Finance House (Malaysia) Berhad	1.000	1.000	1.000
Maybank Islamic Bank Berhad	0.313	0.393	0.797
OCBC Al Amin Bank Berhad	1.000	1.000	1.000
Public Islamic Bank Berhad	0.010	0.496	0.020
RHB Islamic Bank Berhad	1.000	1.000	1.000
Standard Chartered Saadiq Berhad	1.000	1.000	1.000
MEAN	0.542	0.853	0.616

The efficiency level for the year 2010 is shown in Table 4.5. On average, the OTE was 54.2%, PTE 85.3% and SE 61.6%. In 2010, the overall technical inefficiency is also due to the scale inefficiency. Asian Finance Bank Berhad is maintaining their efficiency for this year. Other than that, OCBC Al Amin Bank Berhad, RHB Islamic Bank Berhad and Standard Chartered Saadiq Berhad score full efficiency level in this year. In 2010, Public Islamic Bank Berhad is the least efficient bank compared to other banks. The overall technical inefficiency for this bank is due to scale inefficiency rather than managerial inefficiency.

4.3.4 Efficiency of Islamic banks in Malaysia (2011)

Table 4.6
Efficiency of Islamic banks in Malaysia (2011)

DMU	OTE	PTE	SE
Affin Islamic Bank Berhad	0.452	0.729	0.619
Al-Rajhi Banking and Investment Corporation (Malaysia) Berhad	0.190	0.760	0.250
Alliance Islamic Bank Berhad	0.450	1.000	1.450
Am Islamic Bank Berhad	0.391	0.421	0.928
Asian Finance Bank Berhad	1.000	1.000	1.000
Bank Islam Malaysia Berhad	0.152	0.264	0.573
Bank Muamalat Malaysia Berhad	0.181	0.542	0.334
Hong Leong Islamic Bank Berhad	0.770	0.857	0.899
HSBC Amanah Malaysia Berhad	0.258	0.470	0.549
Kuwait Finance House (Malaysia) Berhad	0.785	0.913	0.859
Maybank Islamic Bank Berhad	0.206	0.611	0.337
OCBC Al Amin Bank Berhad	1.000	1.000	1.000
Public Islamic Bank Berhad	0.597	0.690	0.866
RHB Islamic Bank Berhad	0.927	1.000	0.927
Standard Chartered Saadiq Berhad	1.000	1.000	1.000
MEAN	0.557	0.751	0.706

Next, Table 4.6 above shows the Overall Technical Efficiency (OTE), Pure Technical Efficiency (PTE) and Scale Efficiency (SE) level for the year 2011. OTE for this year is 55.7% while PTE and SE are 75.1% and 70.6% respectively. The overall technical efficiency is mainly contributed by the pure technical efficiency which is also known as managerial efficiency. Asian Finance Bank Berhad and OCBC Al Amin Bank Berhad are maintaining their efficiency level for this year. Apart from these banks, Standard Chartered Saadiq Berhad also achieved the level of efficiency at 100% under OTE, PTE and SE. Bank Islam Malaysia Berhad is the least efficient under OTE and PTE in 2011. However, the SE level of this bank is higher compared to the several other banks.

4.3.5 Efficiency of Islamic banks in Malaysia (2012)

Table 4.7
Efficiency of Islamic banks in Malaysia (2012)

DMU	OTE	PTE	SE
Affin Islamic Bank Berhad	0.241	0.249	0.968
Al-Rajhi Banking and Investment Corporation (Malaysia) Berhad	0.205	0.297	0.691
Alliance Islamic Bank Berhad	0.270	0.321	0.841
Am Islamic Bank Berhad	0.042	0.195	0.214
Asian Finance Bank Berhad	1.000	1.000	1.000
Bank Islam Malaysia Berhad	0.385	1.000	0.385
Bank Muamalat Malaysia Berhad	0.562	0.565	0.993
Hong Leong Islamic Bank Berhad	0.607	0.618	0.982
HSBC Amanah Malaysia Berhad	0.264	0.272	0.971
Kuwait Finance House (Malaysia) Berhad	0.488	0.501	0.975
Maybank Islamic Bank Berhad	1.000	1.000	1.000
OCBC Al Amin Bank Berhad	0.297	0.401	0.739
Public Islamic Bank Berhad	0.081	0.221	0.367
RHB Islamic Bank Berhad	1.000	1.000	1.000
Standard Chartered Saadiq Berhad	0.168	0.345	0.487
MEAN	0.441	0.532	0.774

The efficiency level of Islamic banks in Malaysia for year 2012 is shown in Table 4.7 above. On average, the OTE is 44.1%, PTE is 53.2% and SE is 77.4%. It indicates that, the overall technical inefficiency is mainly due to managerial inefficiency. In 2012, Asian Finance Bank Berhad is still maintaining the level of efficiency for four consecutive years since 2009. Maybank Islamic Bank Berhad and RHB Islamic Bank Berhad are also fully efficient under OTE, PTE and SE. On the contrary, Am Islamic Bank Berhad scores the lowest efficiency level compared to other banks. Based on the result, the overall technical inefficiency of this bank is due to managerial inefficiency rather than scale inefficiency.

4.4 Efficiency of Islamic banks in Bahrain (2008-2012)

4.4.1 Efficiency of Islamic banks in Bahrain (2008)

Table 4.8
Efficiency of Islamic banks in Bahrain (2008)

DMU	OTE	PTE	SE
ABC Islamic Bank	1.000	1.000	1.000
Al-Baraka Banking Group B.S.C	0.048	0.279	0.172
Al-Baraka Islamic Bank B.S.C	0.606	0.916	0.661
Al-Salam Bank B.S.C	0.194	0.230	0.842
Bank Al-Khair B.S.C	0.825	1.000	0.825
Bahrain Islamic Bank B.S.C	0.520	0.537	0.968
Investors Bank B.S.C	1.000	1.000	1.000
Ithmaar Bank B.S.C	0.580	0.888	0.653
Khaleeji Commercial Bank B.S.C	1.000	1.000	1.000
Kuwait Finance House (Bahrain) B.S.C	0.389	0.392	0.992
Liquidity Management Centre B.S.C	1.000	1.000	1.000
Venture Capital Bank B.S.C	1.000	1.000	1.000
MEAN	0.680	0.770	0.843

Notes: DMU- Decision Making Unit OTE- Overall Technical Efficiency
PTE- Pure Technical Efficiency SE- Scale Efficiency

Table 4.8 above shows the Overall Technical Efficiency (OTE), Pure Technical Efficiency (PTE) and Scale Efficiency (SE) level of the Islamic banks for the year 2008. On average, the OTE is 68%, PTE is 77% and SE is 84.3%. Based on the result, overall technical efficiency of the Islamic banks in Bahrain is 68%. The results also show that OTE of Islamic banks in Bahrain in 2008 are mainly come from scale efficiency. Based on the analysis, ABC Islamic Bank, Investors Bank B.S.C, Khaleeji Commercial Bank B.S.C, Liquidity Management Centre B.S.C and Venture Capital Bank B.S.C are fully efficient compared to other banks in this year. On the other hand, Al-Baraka Banking Group B.S.C scores the lowest efficiency level under OTE and SE. However, the PTE level of this bank is higher compared to Al-Salam Bank B.S.C.

4.4.2 Efficiency of Islamic banks in Bahrain (2009)

Table 4.9
Efficiency of Islamic banks in Bahrain (2009)

DMU	OTE	PTE	SE
ABC Islamic Bank	0.479	1.000	0.479
Al-Baraka Banking Group B.S.C	0.599	0.621	0.965
Al-Baraka Islamic Bank B.S.C	1.000	1.000	1.000
Al-Salam Bank B.S.C	1.000	1.000	1.000
Bank Al-Khair B.S.C	0.633	1.000	0.633
Bahrain Islamic Bank B.S.C	1.000	1.000	1.000
First Energy Bank B.S.C	1.000	1.000	1.000
Gulf Finance House B.S.C	1.000	1.000	1.000
Ithmaar Bank B.S.C	0.867	0.933	0.929
Khaleeji Commercial Bank B.S.C	1.000	1.000	1.000
Kuwait Finance House (Bahrain) B.S.C	0.498	0.499	0.998
Liquidity Management Centre B.S.C	1.000	1.000	1.000
MEAN	0.840	0.921	0.917

The efficiency level for the year 2009 is shown in Table 4.9. On average the OTE was 84%, PTE 92.1% and SE 91.7%. It means that only 16% of input used was wasted in producing the same outputs. The overall technical inefficiency of this year is mainly contributed by scale inefficiency. Khaleeji Commercial Bank B.S.C and Liquidity Management Centre B.S.C are maintaining their level of efficiency for the second year of study. Apart from these banks. Al-Baraka Islamic Bank B.S.C. Al-Salam Bank B.S.C, Bahrain Islamic Bank B.S.C, First Energy Bank B.S.C and Gulf Finance House B.S.C are also score the level of efficiency in year 2009. Surprisingly, ABC Islamic Bank who is one of the banks that achieve the level of efficiency in 2008 becomes the least efficient bank under OTE and SE. Nevertheless, this bank is still maintaining the pure technical efficiency or managerial efficiency as in previous year.

4.4.3 Efficiency of Islamic banks in Bahrain (2010)

Table 4.10
Efficiency of Islamic banks in Bahrain (2010)

DMU	OTE	PTE	SE
ABC Islamic Bank	1.000	1.000	1.000
Al-Baraka Banking Group B.S.C	0.148	0.175	0.848
Al-Baraka Islamic Bank B.S.C	1.000	1.000	1.000
Al-Salam Bank B.S.C	0.432	0.692	0.624
Bank Al-Khair B.S.C	1.000	1.000	1.000
Bahrain Islamic Bank B.S.C	0.475	0.556	0.854
First Energy Bank B.S.C	0.886	1.000	0.886
Gulf Finance House B.S.C	0.379	0.731	0.518
Ithmaar Bank B.S.C	0.544	0.549	0.991
Khaleeji Commercial Bank B.S.C	1.000	1.000	1.000
Kuwait Finance House (Bahrain) B.S.C	1.000	1.000	1.000
Liquidity Management Centre B.S.C	1.000	1.000	1.000
MEAN	0.739	0.809	0.893

Next, Table 4.10 above shows the efficiency level for the year 2010. The overall technical efficiency is 73.9% while pure technical efficiency and scale efficiency are 80.9% and 89.3% respectively. It indicates that in 2010, the overall technical inefficiency is due to managerial inefficiency. Based on the analysis, Al-Baraka Islamic Bank B.S.C, Khaleeji Commercial Bank B.S.C and Liquidity Management Centre B.S.C, Bank Al-Khair B.S.C and Kuwait Finance House (Bahrain) B.S.C are score the full efficient in 2010. ABC Islamic Bank who is ranked lowest in 2009, has improved its overall technical efficiency and scale efficiency as compared to year 2009. In contrast, Al-Baraka Banking Group B.S.C is the least efficient bank in this year. Although the bank is efficient in terms of scale efficiency, however it is managed at the inappropriate level.

4.4.4 Efficiency of Islamic banks in Bahrain (2011)

Table 4.11
Efficiency of Islamic banks in Bahrain (2011)

DMU	OTE	PTE	SE
ABC Islamic Bank	1.000	1.000	1.000
Al-Baraka Banking Group B.S.C	0.062	0.189	0.328
Al-Baraka Islamic Bank B.S.C	1.000	1.000	1.000
Al-Salam Bank B.S.C	0.523	0.550	0.951
Bank Al-Khair B.S.C	1.000	1.000	1.000
Bahrain Islamic Bank B.S.C	0.695	0.708	0.981
First Energy Bank B.S.C	0.465	0.648	0.718
Ithmaar Bank B.S.C	0.246	0.396	0.620
Khaleeji Commercial Bank B.S.C	1.000	1.000	1.000
Kuwait Finance House (Bahrain) B.S.C	0.338	0.351	0.964
Liquidity Management Centre B.S.C	1.000	1.000	1.000
MEAN	0.666	0.713	0.869

The efficiency level for the year 2011 is shown in Table 4.11. On average, the overall technical efficiency is 66.6%, pure technical efficiency is 71.3% and scale efficiency is 86.9%. It indicates that, the technical efficiency level in this year is 66.6% and the result show that OTE of Islamic banks in 2011 is mainly contributed by scale efficiency. In this year, ABC Islamic Bank, Al-Baraka Islamic Bank B.S.C, Bank Al-Khair B.S.C, Khaleeji Commercial Bank B.S.C and Liquidity Management Centre B.S.C are fully efficient as well as in previous year. The least efficient bank in 2011 is also Al-Baraka Banking Group B.S.C. This bank is the least efficient in terms of overall technical efficiency, pure technical efficiency and scale efficiency compared to other banks.

4.4.5 Efficiency of Islamic banks in Bahrain (2012)

Table 4.12
Efficiency of Islamic banks in Bahrain (2012)

DMU	OTE	PTE	SE
ABC Islamic Bank	1.000	1.000	1.000
Al-Baraka Banking Group B.S.C	1.000	1.000	1.000
Al-Baraka Islamic Bank B.S.C	1.000	1.000	1.000
Al-Salam Bank B.S.C	0.441	0.456	0.967
Bank Al-Khair B.S.C	1.000	1.000	1.000
Bahrain Islamic Bank B.S.C	0.512	1.000	0.512
Ithmaar Bank B.S.C	0.937	1.000	0.937
Khaleeji Commercial Bank B.S.C	1.000	1.000	1.000
Kuwait Finance House (Bahrain) B.S.C	0.128	0.316	0.403
Liquidity Management Centre B.S.C	0.822	1.000	0.822
Seera Investment Bank B.S.C	1.000	1.000	1.000
MEAN	0.804	0.888	0.876

Table 4.12 shows the level efficiency for year 2012. The overall technical efficiency shows 80.4%. This result recommends that the Islamic banks could have saved 19.6% of the inputs to produce the same amount of outputs that they produced. Meanwhile, pure technical efficiency is 88.8% and scale efficiency is 87.6%. Based on the result, the overall technical inefficiency in this year is due to scale inefficiency. Similar to previous year, ABC Islamic Bank, Al-Baraka Islamic Bank B.S.C, Bank Al-Khair B.S.C, Khaleeji Commercial Bank B.S.C are fully efficient under overall technical efficiency, pure technical efficiency and scale efficiency. Other than that, Al-Baraka Banking Group B.S.C and Seera Investment Bank B.S.C are also score the efficiency level. Al-Baraka Banking Group B.S.C who is the ranked lowest in 2011, has improved its level of efficiency and scores at 100% under overall technical efficiency, pure technical efficiency as well as scale efficiency. However, Kuwait Finance House (Bahrain) B.S.C is the least efficient banks compared to others.

4.5 Mean Efficiency of Islamic banks in Malaysia and Bahrain (2008-2012)

In this section, the mean efficiency of Islamic banks in Malaysia and Bahrain from 2008 to 2012 are presented. There are three different types of efficiency measures which are overall technical efficiency (OTE), pure technical efficiency (PTE), and scale efficiency (SE) as shown in the line chart below.

Figure 4.1: *Mean of Overall Technical Efficiency (OTE)*

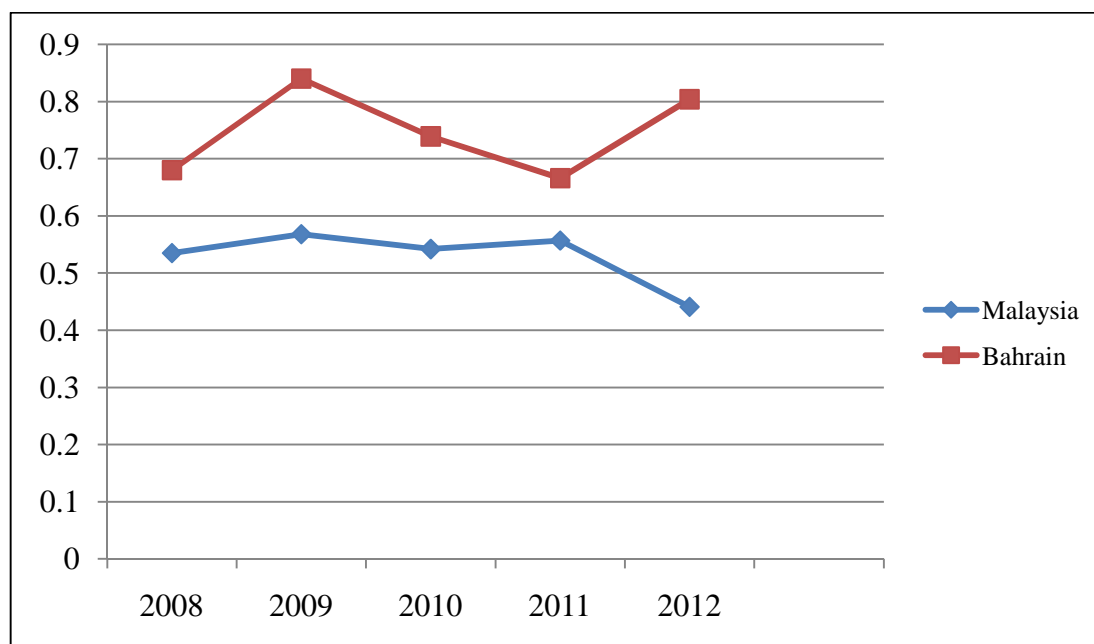
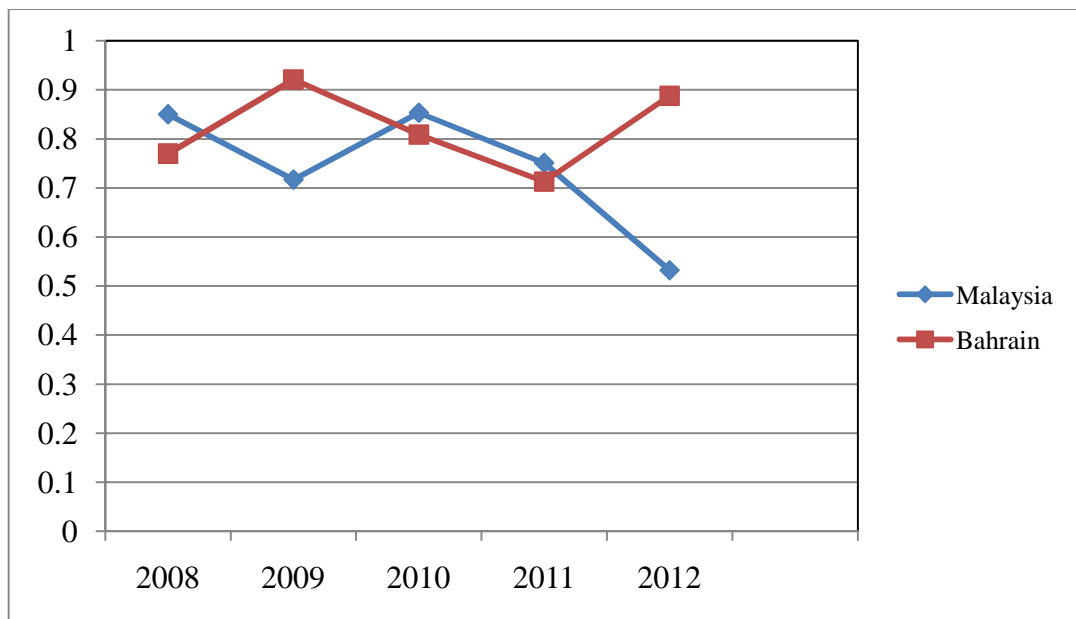


Figure 4.1 above shows the mean of overall technical efficiency (OTE) between Islamic banks in Malaysia and Bahrain from 2008 to 2012. Islamic banks in Malaysia showed a fluctuation between 2008 and 2011. In 2008, the OTE level is 53.5% rise to 56.8% in 2009. However, the OTE level drops to 54.2% in 2010 but it is up slightly to 55.7% in the following year. In 2012, the OTE level suddenly decrease to 44.1%.

Meanwhile, Islamic banks in Bahrain seems to show higher overall technical efficiency compared to Islamic banks in Malaysia. In 2008, the OTE level starts at 68% and grew significantly to 84% in year 2009. Nevertheless, the OTE levels are 73.9% and 66.6% respectively between 2010 and 2011. From 2011, the OTE level upward again to 80.4%. However, the results do not indicate that the OTE in Bahrain is better than Islamic banks in Malaysia. Hence, other test is required to examine the difference between these results.

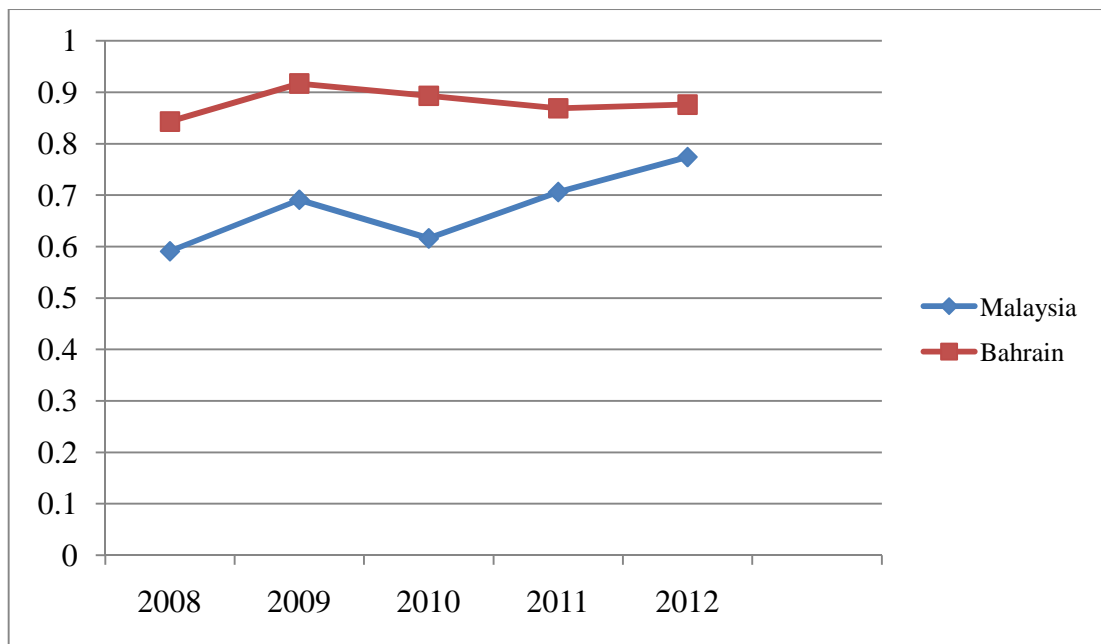
Figure 4.2: *Mean of Pure Technical Efficiency (PTE)*



Next, the mean of pure technical efficiency of Islamic banks in Malaysia and Bahrain during the study period is shown in Figure 4.2. In 2008, the PTE level of Malaysia is higher compared to Bahrain which represent 85% and 77% respectively. It seems to indicate that managerial efficiency of Islamic banks in Malaysia is higher than Islamic banks in Bahrain for this year. For the following year, Bahrain turned to

show the increasing trend of PTE level rather than Malaysia. The PTE level of Bahrain is increased to 92.1% whereas the PTE level of Malaysia decreased to 71.7%. However, the PTE level of Islamic banks in Bahrain decreased for two consecutive years which are 2010 and 2011 and increased again to 88.8% in 2012. In contrast, the PTE level of Islamic banks in Malaysia increased in 2010 which is 85.3% but decreased in the next two years to 75.1% and 53.2% only. Nevertheless, other test is required to differentiate these results.

Figure 4.3: *Mean of Scale Efficiency (SE)*



Lastly, Figure 4.3 shows the mean of scale efficiency between Islamic banks in Malaysia and Bahrain from 2008 to 2012. Based on the figure, it seems that SE level of Islamic banks in Bahrain are better than the SE level of Islamic banks in Malaysia. However, further analysis is required to test the difference between these two groups.

In 2008, the SE level of Bahrain is 84.3% and it increase to 91.7% for the following year. After that, the SE level drops slightly between 2010 to 2011 which are 89.3% and 86.9%. The SE level becomes increase to 87.6% in 2012. On contrary, the SE level of Malaysia is around 59.1% for the first year of study and rise up to 69.1% in 2009. Then, the SE level of Malaysia shows decreasing in 2010 and increasing for the next two years. The SE level in 2010 is 61.6% and for the last two years are 70.6% and 77.4% respectively.

4.6 Return to Scale for Islamic Banks

It is worth to write the return to scale of Islamic banks during the study period. As have been mentioned earlier, this study used a VRS assumption (based on the BCC model). If the Pure Technical Efficiency (PTE) score equals Overall Technical Efficiency (OTE) score, the bank is said to operating at a constant returns to scale (CRS).

Further, a bank operating at non-CRS can be operating at increasing return to scale (IRS) or decreasing return to scale (DRS). IRS means a rise in inputs resulted in a more than proportionate rise in outputs whereas DRS refers to the bank increases its outputs, the result will be a less than proportionate increase in their outputs. Table 4.13 and Table 4.14 below summarize the details of each year score for Islamic banks in Malaysia and Bahrain as a whole.

4.6.1 Return to Scale of Islamic Banks in Malaysia

Table 4.13
Return to Scale of Islamic banks in Malaysia

YEAR	CRS	%	IRS	%	DRS	%	TOTAL
2008	5	33.33	1	6.67	9	60	15
2009	5	31.25	9	56.25	2	12.5	16
2010	5	33.33	8	53.33	2	13.33	15
2011	3	20	10	66.67	2	13.33	15
2012	3	20	11	73.33	1	6.67	15
OVERALL	21	27.63	39	51.32	16	21.05	76

Notes: CRS- Constant Return to Scale IRS- Increasing Return to Scale
DRS- Decreasing Return to Scale

From the results reported in Table 4.13 above, in terms of CRS, only 27.63% of the banks are operating at constant return to scale (CRS). It means only small percentage of Islamic banks were operating at the right scale. Other 72.37% were operating at non-CRS. It means that majority of Islamic banks in Malaysia during the study period were operating at non-CRS.

4.6.2 Return to scale of Islamic Banks in Bahrain

Table 4.14
Return to Scale of Islamic banks in Bahrain

YEAR	CRS	%	IRS	%	DRS	%	TOTAL
2008	5	41.67	4	33.33	3	25	12
2009	7	58.33	4	33.33	1	8.33	12
2010	6	50	5	41.67	1	8.33	12
2011	5	45.45	5	45.45	1	9.10	11
2012	6	54.55	3	27.27	2	18.18	11
OVERALL	29	50	21	36.20	8	13.80	58

Further the study was carried out by calculating the percentage of the Islamic banks based on their return to scale in Bahrain. The results is shown in Table 4.14. Overall, 50% of Islamic banks in Bahrain are operating at CRS. Hence, the result indicates that half of Islamic banks in Bahrain were operating at non-CRS.

4.7 Independent Sample T-test

After examining the results of efficiency level, the issue of interest now is whether the differences of efficiency between Islamic banks in Malaysia and Bahrain during 2008 to 2012 are significant. Hence, the study utilized a series of parametric test (T-test) along with non-parametric test (Mann-Whitney [Wilcoxon Rank Sum]) which is suggested by Coakes and Steed (2003) to obtain the results. Table 4.15 below summarizes a summary of both test in order to compare the efficiency level in terms of OTE, PTE and SE between both countries. The findings are reported in table below.

Table 4.15
Summary of Parametric and Non-Parametric Tests

	Test Groups			
	Parametric Test		Non-Parametric Test	
Individual tests	T-test		Mann-Whitney [Wilcoxon Rank-Sum] test	
Test Statistics	t(Prb> t)		z(Prb> z)	
	Mean	t	Mean Rank	z
Technical Efficiency (TE)				
Malaysia	0.2188	-3.571***	54.90	- 4.300***
Bahrain	0.3970		84.01	
Pure Technical Efficiency (PTE)				
Malaysia	0.3141	-3.741***	55.53	- 4.098***
Bahrain	0.5335		83.19	
Scale Efficiency (SE)				
Malaysia	0.6288	-2.255***	61.47	- 2.059***
Bahrain	0.7244		75.41	

Note: *** indicates significant at 1% level

Table 4.15 above represents the results from the parametric t-test and non-parametric Mann-Whitney [Wilcoxon] test. The results recommend that Islamic banks in Bahrain have exhibited a higher mean technical efficiency level compared to Islamic banks in Malaysia. Likewise, Islamic banks in Bahrain have also exhibited a higher mean pure technical efficiency level and scale efficiency level than Malaysian Islamic banks. These results are significant at 1% level. The parametric test and non-parametric test can be referred in Appendices B.

4.8 Conclusion

This chapter provides the results and discussions in order to examine the efficiency level of Islamic banks between Malaysia and Bahrain for study period from 2008 to 2012. Based on the results, it found that Islamic banks in Bahrain have higher technical efficiency compared to Islamic banks in Malaysia which due to higher scale efficiency. Other than that, Islamic banks in Bahrain also have higher efficiency level in terms of managerial rather than Malaysia. The next chapter is conclusion and recommendations.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

As stated earlier, the objective of this study is to examine the efficiency of Islamic banks in Malaysia and Bahrain during the period from 2008 to 2012 and to examine the source of overall technical efficiency of Islamic banks in both countries. The efficiency was estimated using the non-parametric Data Envelopment Analysis (DEA) approach and it has allowed to distinguish three types of efficiency such as technical, pure technical and scale efficiency. DEA was utilized 16 Islamic banks in Malaysia and 15 Islamic banks in Bahrain. Additionally, the study has performed a series of parametric and non-parametric tests in order to see the differences between both countries.

5.2 Summary of Findings

The study found that the mean of overall technical efficiency (OTE) for Islamic banks in Malaysia scores around 0.441 to 0.568. In terms of pure technical efficiency (PTE), the score of Malaysian Islamic banks is around 0.532 to 0.853 whereas scale efficiency (SE) score are about 0.591 to 0.774. As a whole, overall technical efficiency contributed mainly by pure technical efficiency. In other words, scale inefficiency leads to the overall technical inefficiency. The results recommends that Islamic banks in Malaysia have been operating at wrong scale and it is consistent with the result of a return to scale (RTS) whereby 72.37% of the samples were operating at non-constant return to scale.

The result also shows Islamic banks in Bahrain score around 0.666 to 0.840 of overall technical efficiency. In terms of pure technical efficiency, Islamic banks in Bahrain score about 0.713 to 0.921. Meanwhile, for scale efficiency score between 0.843 to 0.917. The results indicate that scale efficiency, dominated more to overall technical efficiency. Based on the result of a return to scale, Islamic banks in Bahrain represent the balance score whereby 50% of the samples were operating at constant return to scale and another 50% were operating at non-constant return to scale.

Then, a series of parametric test (T-test) and non-parametric test (Mann-Whitney Test) is utilized in order to compare the efficiency level in terms of overall technical efficiency and its decomposition of pure technical efficiency and scale efficiency. Based on the both tests, we can see Islamic banks in Bahrain are efficient in terms of technical efficiency rather Islamic banks in Malaysia. Besides that, the pure technical efficiency of Islamic banks in Bahrain also shows a higher results as well as scale efficiency compared to Malaysian Islamic banks during the study period.

There are several factors that contribute to the high efficiency of Islamic banking in Bahrain. Perhaps the main factor that leads the Islamic banks are efficient in terms of managerial efficiency and technological advancement. It may indicate that management of Islamic banks in Bahrain is well organized, reflecting the effective roles as the mediator between customers. In addition, the technology used by Islamic banks in Bahrain may be assumed as up to date and being fully utilized in the bank's operation.

Next, country's economic condition could be one of the factors which contribute to an efficient level of Islamic banks in Bahrain. It measured by Gross Domestic Product (GDP) per capita, which is an important indicator of efficiency. This is due to the fact that the income per capita of a country can affect many factors related to the activities of financial intermediaries. It indicates that the demand for Islamic banking products and services tends to grow as economies expand and societies become wealthier.

Bahrain and Malaysia are globally recognized as Islamic banking hubs. The first Islamic bank was established in 1979 which is Bahrain Islamic Bank while Islamic banking started in Malaysia in 1983. The efficiency level of Islamic banks in Bahrain is also affected by the establishment of the Islamic banks since the establishment of Islamic banks in Bahrain is earlier compared to the establishment of Islamic banks in Malaysia.

Based on the findings, 50% of Islamic banks in Bahrain were operating at constant return to scale (CRS) rather than Islamic banks in Malaysia which is only 27.63%. Hence, it means Islamic banks in this country were operating at the most productive scale size by utilizing their input and output very well without any wastage.

5.3 Policy Implications and Recommendations

Generally, Islamic banking industry was developed initially to fulfil the needs of Muslims and now gained universal acceptance. The Islamic banking industry is recognized as one fastest growing area and as a viable alternative to conventional banking industry. Perhaps because Bahrain and Malaysia are leading as Islamic financial hubs, this study analysis hopefully can assist the Islamic bank management in order to find out the best way to improve their level of efficiency as a whole. Therefore, several recommendations are put forward to help Islamic banks in Malaysia in order to improve the efficiency level of the banks.

Islamic banks in Malaysia should strengthen and develop its capability and the strength of its institution and operation so that they will operate successfully in global competition. Hence, the Islamic banking here can make the Islamic banking in Bahrain as a role model and look at their management structure, the technology system used and others in the improvement process of Malaysian's of Islamic banking industry.

Proper management and rewards are key to improve the performance levels. The rewards can be in the form of financial compensation, career progression, or any "employee of the month" awards. A properly structured incentive system can become a powerful tool for retaining staff, particularly important in Islamic banking given the general shortage of skilled resources. The key is linking rewards directly to performance measures pre-defined at the employee level to ensure that hard-won improvements are sustained.

In addition, Malaysia must establish a strong research and development institute to produce innovative products and services that can encourage Islamic banking in Malaysia, also known as the leader of a Shariah-compliant community. The efforts made by the International Shariah Research Academy for Islamic Finance is kindly appreciated in order to improve the sustainability of Islamic banking industry. Indirectly, the research and development part subsequently lead to the innovation efforts in Islamic financial products.

5.3 Limitations and Recommendations of Future Research

The study focuses on the Islamic bank's efficiency in Malaysia and Bahrain for a selected period of 2008-2012. There are a few types of efficiency, but this study is limited to technical efficiency only. The study is also limited to Islamic banks in Malaysia and Bahrain. Due to the limitations, the paper could be extended in a variety of ways.

Firstly, the scope of this study could be further extended to investigate changes in cost, allocative and technical efficiencies. Since the study only covers a sample period of five years (2008-2012), future research might cover more sample periods. In addition, further studies could also take a bigger sample size by including Islamic and conventional banks or increase the number of countries.

Secondly, it is suggested that further analysis in the investigation of the Islamic banking sector efficiency to consider risk exposure factors or determinants of efficiency in the Islamic banking industry such as size, ownership and regulation within that country.

Thirdly, it is recommended to consider the production function along with the intermediation function. Besides that, the inputs and outputs identification could be diversified more inputs and outputs since this study only focuses on two inputs and two variables only.

Therefore, the bank managers, government regulators and investors can use the information obtained from efficiency studies in order to evaluate the performance of Islamic banks itself. Managerial performance can be improved by identifying “best practice” and “worst practice” associated with high and low efficiency firms respectively. Hence, the results of this study are expected to contribute significantly to the existing knowledge on the operations of the Islamic banking industry in spite of these limitations. It also provides a way to generate ideas for management of banks and policy makers to improve the management and more. It is a great way to simplify instructions to sustainable competitive future of Islamic banking operations in Malaysia and Bahrain.

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APPENDIX A

DATA ENVELOPMENT ANALYSIS

TEST

APPENDIX A : DATA ENVELOPMENT ANALYSIS TEST

a) Efficiency of Islamic Banks in Malaysia (2008)

EFFICIENCY SUMMARY:

firm	crste	vrste	scale	
1	1.000	1.000	1.000	-
2	0.678	1.000	0.678	drs
3	1.000	1.000	1.000	-
4	0.133	1.000	0.133	drs
5	0.350	1.000	0.350	drs
6	0.093	0.317	0.292	drs
7	0.171	0.723	0.237	drs
8	0.194	0.393	0.493	irs
9	0.684	1.000	0.684	drs
10	0.216	1.000	0.216	drs
11	0.383	1.000	0.383	drs
12	1.000	1.000	1.000	-
13	1.000	1.000	1.000	-
14	0.127	0.320	0.397	drs
15	1.000	1.000	1.000	-
mean	0.535	0.850	0.591	

Note: crste = technical efficiency from CRS DEA
vrste = technical efficiency from VRS DEA
scale = scale efficiency = crste/vrste

b) Efficiency of Islamic Banks in Malaysia (2009)

EFFICIENCY SUMMARY:

firm	crste	vrste	scale	
1	1.000	1.000	1.000	-
2	0.526	1.000	0.526	irs
3	1.000	1.000	1.000	-
4	1.000	1.000	1.000	-
5	1.000	1.000	1.000	-
6	0.671	1.000	0.671	drs
7	0.017	0.366	0.046	irs
8	0.052	0.239	0.217	irs
9	0.387	0.679	0.571	irs
10	1.000	1.000	1.000	-
11	0.229	0.403	0.569	irs
12	0.110	0.223	0.494	irs
13	0.066	0.312	0.212	irs
14	0.325	0.344	0.944	irs
15	0.817	1.000	0.817	drs
16	0.889	0.903	0.984	irs
mean	0.568	0.717	0.691	

Note: crste = technical efficiency from CRS DEA
vrste = technical efficiency from VRS DEA
scale = scale efficiency = crste/vrste

c) Efficiency of Islamic Banks in Malaysia (2010)

EFFICIENCY SUMMARY:

firm	crste	vrste	scale	
1	0.156	0.893	0.175	irs
2	0.365	0.832	0.438	irs
3	0.076	1.000	0.076	irs
4	0.647	1.000	0.647	drs
5	1.000	1.000	1.000	-
6	0.527	0.544	0.968	drs
7	0.036	0.753	0.048	irs
8	0.442	1.000	0.442	irs
9	0.556	0.882	0.630	irs
10	1.000	1.000	1.000	-
11	0.313	0.393	0.797	irs
12	1.000	1.000	1.000	-
13	0.010	0.496	0.020	irs
14	1.000	1.000	1.000	-
15	1.000	1.000	1.000	-
mean	0.542	0.853	0.616	

Note: crste = technical efficiency from CRS DEA
vrste = technical efficiency from VRS DEA
scale = scale efficiency = crste/vrste

d) Efficiency of Islamic Banks in Malaysia (2011)

EFFICIENCY SUMMARY:

firm	crste	vrste	scale	
1	0.452	0.729	0.619	irs
2	0.190	0.760	0.250	irs
3	0.450	1.000	0.450	irs
4	0.391	0.421	0.928	irs
5	1.000	1.000	1.000	-
6	0.152	0.264	0.573	irs
7	0.181	0.542	0.334	irs
8	0.770	0.857	0.899	irs
9	0.258	0.470	0.549	irs
10	0.785	0.913	0.859	irs
11	0.206	0.611	0.337	irs
12	1.000	1.000	1.000	-
13	0.597	0.690	0.866	drs
14	0.927	1.000	0.927	drs
15	1.000	1.000	1.000	-
mean	0.557	0.751	0.706	

Note: crste = technical efficiency from CRS DEA
vrste = technical efficiency from VRS DEA
scale = scale efficiency = crste/vrste

e) Efficiency of Islamic Banks in Malaysia (2012)

EFFICIENCY SUMMARY:

firm	crste	vrste	scale	
1	0.241	0.249	0.968	irs
2	0.205	0.297	0.691	irs
3	0.270	0.321	0.841	irs
4	0.042	0.195	0.214	irs
5	1.000	1.000	1.000	-
6	0.385	1.000	0.385	drs
7	0.562	0.565	0.993	irs
8	0.607	0.618	0.982	irs
9	0.264	0.272	0.971	irs
10	0.488	0.501	0.975	irs
11	1.000	1.000	1.000	-
12	0.297	0.401	0.739	irs
13	0.081	0.221	0.367	irs
14	1.000	1.000	1.000	-
15	0.168	0.345	0.487	irs
mean	0.441	0.532	0.774	

Note: crste = technical efficiency from CRS DEA
 vrste = technical efficiency from VRS DEA
 scale = scale efficiency = crste/vrste

f) Efficiency of Islamic Banks in Bahrain (2008)

EFFICIENCY SUMMARY:

firm	crste	vrste	scale	
1	1.000	1.000	1.000	-
2	0.048	0.279	0.172	irs
3	0.606	0.916	0.661	irs
4	0.194	0.230	0.842	irs
5	0.825	1.000	0.825	drs
6	0.520	0.537	0.968	drs
7	1.000	1.000	1.000	-
8	0.580	0.888	0.653	irs
9	1.000	1.000	1.000	-
10	0.389	0.392	0.992	drs
11	1.000	1.000	1.000	-
12	1.000	1.000	1.000	-
mean	0.680	0.770	0.843	

Note: crste = technical efficiency from CRS DEA
 vrste = technical efficiency from VRS DEA
 scale = scale efficiency = crste/vrste

g) Efficiency of Islamic Banks in Bahrain (2009)

EFFICIENCY SUMMARY:

firm	crste	vrste	scale	
1	0.479	1.000	0.479	irs
2	0.599	0.621	0.965	irs
3	1.000	1.000	1.000	-
4	1.000	1.000	1.000	-
5	0.633	1.000	0.633	drs
6	1.000	1.000	1.000	-
7	1.000	1.000	1.000	-
8	1.000	1.000	1.000	-
9	0.867	0.933	0.929	irs
10	1.000	1.000	1.000	-
11	0.498	0.499	0.998	irs
12	1.000	1.000	1.000	-
mean	0.840	0.921	0.917	

Note: crste = technical efficiency from CRS DEA
vrste = technical efficiency from VRS DEA
scale = scale efficiency = crste/vrste

h) Efficiency of Islamic Banks in Bahrain (2010)

EFFICIENCY SUMMARY:

firm	crste	vrste	scale	
1	1.000	1.000	1.000	-
2	0.148	0.175	0.848	irs
3	1.000	1.000	1.000	-
4	0.432	0.692	0.624	irs
5	1.000	1.000	1.000	-
6	0.475	0.556	0.854	irs
7	0.886	1.000	0.886	irs
8	0.379	0.731	0.518	irs
9	0.544	0.549	0.991	drs
10	1.000	1.000	1.000	-
11	1.000	1.000	1.000	-
12	1.000	1.000	1.000	-
mean	0.739	0.809	0.893	

Note: crste = technical efficiency from CRS DEA
vrste = technical efficiency from VRS DEA
scale = scale efficiency = crste/vrste

i) Efficiency of Islamic Banks in Bahrain (2011)

EFFICIENCY SUMMARY:

firm	crste	vrste	scale	
1	1.000	1.000	1.000	-
2	0.062	0.189	0.328	irs
3	1.000	1.000	1.000	-
4	0.523	0.550	0.951	irs
5	1.000	1.000	1.000	-
6	0.695	0.708	0.981	irs
7	0.465	0.648	0.718	drs
8	0.246	0.396	0.620	irs
9	1.000	1.000	1.000	-
10	0.338	0.351	0.964	irs
11	1.000	1.000	1.000	-
mean	0.666	0.713	0.869	

Note: crste = technical efficiency from CRS DEA
 vrste = technical efficiency from VRS DEA
 scale = scale efficiency = crste/vrste

j) Efficiency of Islamic Banks in Bahrain (2012)

EFFICIENCY SUMMARY:

firm	crste	vrste	scale	
1	1.000	1.000	1.000	-
2	1.000	1.000	1.000	-
3	1.000	1.000	1.000	-
4	0.441	0.456	0.967	irs
5	1.000	1.000	1.000	-
6	0.512	1.000	0.512	drs
7	0.937	1.000	0.937	drs
8	1.000	1.000	1.000	-
9	0.128	0.316	0.403	irs
10	0.822	1.000	0.822	irs
11	1.000	1.000	1.000	-
mean	0.804	0.888	0.876	

Note: crste = technical efficiency from CRS DEA
 vrste = technical efficiency from VRS DEA
 scale = scale efficiency = crste/vrste

APPENDIX B

PARAMETRIC AND

NON-PARAMETRIC TEST

APPENDIX B : PARAMETRIC AND NON-PARAMETRIC TEST

a) Overall Technical Efficiency (OTE)

i) Parametric Test (T-Test)

Group Statistics

COUNTRY	N	Mean	Std. Deviation	Std. Error Mean
OTE 1	76	.2188	.26404	.03029
0	58	.3970	.30140	.03958

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
OTE	Equal variances assumed	5.790	.017	-3.641	132	.000	-.17824	.04896	-.27508	-.08140
	Equal variances not assumed			-3.577	113.686	.001	-.17824	.04984	-.27697	-.07951

ii) **Non Parametric Test (Mann-Whitney Test)**

Ranks

	COUNTRY	N	Mean Rank	Sum of Ranks
OTE	0	58	84.01	4872.50
	1	76	54.90	4172.50
	Total	134		

Test Statistics^a

	OTE
Mann-Whitney U	1246.50
Wilcoxon W	4172.50
Z	-4.300
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: COUNTRY

b) Pure Technical Efficiency (PTE)

i) Parametric Test (T-Test)

Group Statistics

	COUNTRY	N	Mean	Std. Deviation	Std. Error Mean
PTE	1	76	.3141	.31725	.03639
	0	58	.5335	.35020	.04598

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
PTE	Equal variances assumed	8.133	.005	-3.792	132	.000	-.21940	.05786	-.33386	-.10494
	Equal variances not assumed			-3.741	116.137	.000	-.21940	.05864	-.33555	-.10326

ii) **Non Parametric Test (Mann-Whitney Test)**

Ranks

COUNTRY	N	Mean Rank	Sum of Ranks
PTE 0	58	83.19	4825.00
1	76	55.53	4220.00
Total	134		

Test Statistics^a

	PTE
Mann-Whitney U	1294.00
Wilcoxon W	4220.00
Z	-4.098
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: COUNTRY

c) Scale Efficiency (SE)

i) Parametric Test (T-Test)

Group Statistics

	COUNTRY	N	Mean	Std. Deviation	Std. Error Mean
SE	1	76	.6288	.26451	.03034
	0	58	.7244	.22553	.02961

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
SE	Equal variances assumed	1.678	.197	-2.208	132	.029	-.09562	.04332	-.18131	-.00994
	Equal variances not assumed			-2.255	130.331	.026	-.09562	.04240	-.17950	-.01175

ii) **Non Parametric Test (Mann-Whitney Test)**

Ranks

	COUNTRY	N	Mean Rank	Sum of Ranks
SE	0	58	75.41	4373.50
	1	76	61.47	4671.50
	Total	134		

Test Statistics^a

	SE
Mann-Whitney U	1745.50
Wilcoxon W	4671.50
Z	-2.059
Asymp. Sig. (2-tailed)	.039

a. Grouping Variable: COUNTRY