THE LEVEL OF TECHNICAL EFFICIENCY AND ITS DETERMINANTS IN MALAYSIA'S DEVELOPMENT FINANCIAL INSTITUTIONS

NAZRI BIN HASHIM

UNIVERSITI PENDIDIKAN SULTAN IDRIS

2024

THE LEVEL OF TECHNICAL EFFICIENCY AND ITS DETERMINANTS IN MALAYSIA'S DEVELOPMENT FINANCIAL INSTITUTIONS

NAZRI BIN HASHIM

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

DISSERTATION PRESENTED TO QUALIFY FOR A MASTER OF ACCOUNTING
(RESEARCH MODE)

FACULTY OF MANAGEMENT AND ECONOMY
UNIVERSITI PENDIDIKAN SULTAN IDRIS

2024

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

UPSI/IPS-3/BO 32
Pind : 00 m/s: 1/1

UNIVERSITI PENDIDIKAN SULTAN IDRIS
SULTAN IDRIS EDUCATION UNIVERSITY

Please tick (✓)	
Project Paper	
Masters by Research	/
Masters by Mix Mode	
Ph.D	

INSTITUTE OF GRADUATE STUDIES

DECLARATION OF ORIGINAL WORK

This declaration is made on the 12th day of Mac 2024.

i. Student's Declaration:

I, Nazri Hashim, M20192001223, Faculty of Management and Economy hereby declare that the work entitled The Level of Technical Efficiency and its Determinants in Malaysia's Development Financial Institutions is my original work. I have not plagiarised from any other scholar's work and any sources that contains copyright had been cited properly for the permitted meanings. Any quotations, excerpt, reference or re-publication from or any works that has copyright had been clearly and well cited.

Signature of the student

ii. Supervisor's Declaration:

I, Dr. Mohd Faizal Basri hereby certifies that the work entitled The Level of Technical Efficiency and its Determinants in Malaysia's Development Financial Institutions was prepared by the above named student, and was submitted to the Institute of Graduate Studies as a partial / full fulfilment for the conferment of Master's Degree In Accounting (Islamic Finance) (Research Mode) and the aforementioned work, to the best of my knowledge, is the said student's work.

12th day of Mac 2024
Date

Signature of the Supervisor

UPSI/IPS-3/BO 31
Pind.: 01 m/s:1/1

UNIVERSITI PENDIDIKAN SULTAN IDRIS
SULTAN IDRIS EDUCATION UNIVERSITY

INSTITUT PENGAJIAN SISWAZAH /
INSTITUTE OF GRADUATE STUDIES

BORANG PENGESAHAN PENYERAHAN TESIS/DISERTASI/LAPORAN KERTAS PROJEK
DECLARATION OF THESIS/DISSERTATION/PROJECT PAPER FORM

Tajuk/Title: The Level of Technical Efficiency and its Determinants in Malaysia's Development Financial Institutions

No. Matrik /*Matric's No.*: M20192001223

Saya/*I:* Nazri Hashim

Mengaku membenarkan Tesis/Disertasi/Laporan Kertas Projek (Kedoktoran/Sarjana)* ini disimpan di Universiti Pendidikan Sultan Idris (Perpustakaan Tuanku Bainun) dengan syarat-syarat kegunaan seperti berikut:-
acknowledged that Universiti Pendidikan Sultan Idris (Tuanku Bainun Library) reserves the right as follows:-

1. Tesis/Disertasi/Laporan Kertas Projek ini adalah hak milik UPSI.
   The thesis is the property of Universiti Pendidikan Sultan Idris
2. Perpustakaan Tuanku Bainun dibenarkan membuat salinan untuk tujuan rujukan dan penyelidikan.
   Tuanku Bainun Library has the right to make copies for the purpose of reference and research.
3. Perpustakaan dibenarkan membuat salinan Tesis/Disertasi ini sebagai bahan pertukaran antara Institusi Pengajian Tinggi.
   The Library has the right to make copies of the thesis for academic exchange.
4. Sila tandakan (√) bagi pilihan kategori di bawah */ Please tick (√) for category below:-*

☐	***SULIT/ CONFIDENTIAL***	Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub dalam Akta Rahsia Rasmi 1972. / *Contains confidential information under the Official Secret Act 1972*
☐	***TERHAD/ RESTRICTED***	Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan ini dijalankan. / *Contains restircted information as specified by the organization where research was done*
☑	***TIDAK TERHAD/ OPEN ACCESS***	

(Tandatangan Pelajar/ Signature)

(Tandatangan Penyelia / Signature of Supervisor) & (Nama & Cop Rasmi / Name & Official Stamp)

PROFESOR MADYA DR. MOHD FAIZAL BASRI
Jabatan Perakaunan dan Kewangan
Fakulti Pengurusan dan Ekonomi
Universiti Pendidikan Sultan Idris
35900 Tanjong Malim, Perak

Tarikh: 12th day of Mac 2024

Catatan: Jika Tesis/Disertasi ini **SULIT** @ **TERHAD**, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan ini perlu dikelaskan sebagai **SULIT** dan **TERHAD**.
Notes: If the thesis is CONFIDENTAL or RESTRICTED, please attach with the letter from the organization with period and reasons for confidentiality or restriction

ACKNOWLEDGEMENT

In the name of Allah S.W.T, the Most Gracious and the Most Merciful, peace and blessings be upon the Prophet Muhammad ﷺ and his family. Alhamdulillah, thanks to God, with His permission, this study can be completed successfully. I admit, indeed this power and effort belongs to Al-Muhyii, the grace of time and the senses belongs to An-Naafi' and this gift of knowledge also remains the property of Al-Hakiim. Thank you for His permission to start and finish this study. A wreath of appreciation for the respected, Associate Professor Dr. Mohd Faizal Basri and Associate Professor Dr. Mohd Yahya Mohd Hussin as the study supervisors. Thank you for the pearls of knowledge, advice, guidance, and unrequited experience. Only Allah S.W.T. can repay all the good services given. Not forgetting, for all lecturers, thank you for the guidance together. For family, thank you for your blessing and trust. May the love continue to last, to believe and pray for this success. For a comrade in arms, thank you for being loyal. Finally, I hope this study will benefit the development of Islamic Finance and become a source of knowledge for the community. May this small effort be accepted by Allah S.W.T as a small jihad in developing the economy of Muslims.

Jazakumullahu khair al-jaza', amen.

ABSTRACT

This study aims to identify the technical efficiency (TE) of ten Development Financial Institutions (DFIs) in Malaysia. Subsequently, this study intends to identify the determinants of their efficiency. The first objective is assessed using the Data Envelopment Analysis (DEA) estimation method under a non-parametric approach. The variables employed are fixed assets and labor as inputs, with financing as the output. The second objective is analyzed using Ordinary Least Squares (OLS) regression based on the estimation model. Five financial ratio variables are selected as determinants of DFIs' efficiency, encompassing the ratio of capitalization, liquidity risk, bank size, profitability and credit risk. Both analyses are conducted on annual data spanning from 2009 to 2018, utilizing information derived from bank reports. The DEA results reveal that only Sabah Development Bank Berhad (SDB) achieved full efficiency levels at each stage of analysis (CRSTE=100%, VRSTE=100%, scale=100%). OLS results show that only the variables of bank size (*t*-test=0.017, *p*=5%) and profit ratio (*t*-test=0.035, *p*=5%) have a significant relationship with TE. In conclusion, with the exception of SDB, the remaining nine DFIs need to enhance their efficiency levels in accordance to the law of returns to scale through input and output orientation, ensuring efficient resource management. Top management should consider the variables of bank size and profitability ratio as crucial indicators for improving TE in DFIs. As an implication, this analysis offer valuable insights to the government for making informed operational decisions regarding DFIs, with the aim of fostering the contribution of the DFIs in developing and improving the socio-economic development of the country.

TAHAP KECEKAPAN TEKNIKAL DAN PENENTU-PENENTUNYA DALAM INSTITUSI PEMBANGUNAN KEWANGAN MALAYSIA

ABSTRAK

Kajian ini bertujuan mengenal pasti kecekapan teknikal (TE) ke atas sepuluh Institusi Pembangunan Kewangan (DFI) di Malaysia. Seterusnya, kajian ini bermatlamat untuk mengenal pasti faktor-faktor yang mempengaruhi kecekapan institusi ini. Objektif pertama diuji menggunakan kaedah anggaran *Data Envelopment Analysis* (DEA) di bawah pendekatan bukan-parametrik. Pembolehubah yang digunakan adalah aset tetap dan buruh sebagai input, dengan pembiayaan sebagai output. Objektif kedua dianalisis menggunakan regresi *Ordinary Least Squares* (OLS) berdasarkan model anggaran. Lima pemboleh ubah nisbah kewangan dipilih sebagai penentu kecekapan DFI yang terdiri daripada nisbah permodalan, risiko kecairan, saiz bank, keuntungan, dan risiko kredit. Kedua-dua analisis dijalankan ke atas data tahunan dari 2009 hingga 2018 dengan menggunakan data dari laporan bank. Keputusan DEA menunjukkan hanya Sabah Development Bank Berhad (SDB) sahaja yang mencatatkan tahap kecekapan penuh di setiap peringkat analisis (CRSTE=100%, VRSTE=100%, skala=100%). Keputusan OLS pula menunjukkan hanya pembolehubah saiz bank (ujian-t=0.017, p=5%) dan nisbah keuntungan (ujian-t=0.035, p=5%) sahaja yang mempunyai hubungan signifikan dengan TE. Sebagai kesimpulan, selain SDB, sembilan DFI yang lain perlu meningkatkan tahap kecekapan mengikut undang-undang pulangan ke skala menerusi orientasi input dan output untuk memastikan pengurusan sumber yang cekap. Pihak pengurusan perlu mempertimbangkan pemboleh ubah saiz bank dan nisbah keuntungan sebagai petunjuk penting untuk meningkatkan TE dalam DFI. Sebagai implikasi, analisis ini memberikan maklumat yang berharga kepada kerajaan untuk membuat keputusan operasi yang berinformasi berkaitan dengan DFI, dengan tujuan meningkatkan sumbangan DFI dalam membangunkan dan meningkatkan pembangunan sosioekonomi negara.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AIC	Akaike Information Criterion
ASEAN	Association Of Southeast Asian Nations
BAM	Murabahah Revolving Financing
BG-*i*	Islamic Bank Guarantee
BIC	Bayesian Information Criterion
BNM	Bank Negara Malaysia
BPMB	Bank Pembangunan Malaysia Berhad
BSN	Bank Simpanan Nasional
CE	Common Effect
CFI	Corporate Finance Institute
CGC	Credit Guarantee Corporation Malaysia Berhad
CMRF-*i*	Commodity Murabahah Revolving Financing-*i*
CMTF-*i*	Commodity Murabahah Term Financing-*i*
CRS	Constant Returns to Scale
DEA	Data Envelopment Analysis
DFA	Distribution-Free Approach
DFI	Development Financial Institutions
DFIA	Development Financial Institutions Act 2002
DMU	Decision-Making Unit
drs	Diminishing Return to Scale

DRTS	Decreasing Return to Scale
DV	Dependent Variable
DWH	Durbin–Wu–Hausman
e.g	For Example
EQTA	Capitalization
et al.	et alia
EXIM	Export-Import Bank Of Malaysia Berhad
F	Financing
FDH	Free Disposal Hull Analysis
FDIC	Federal Deposit Insurance Corporation
FE	Fixed Assets
FRBSF	Federal Reserve Bank of San Francisco
GCC	Gulf Cooperative Council
GLS	Generalized Least Squares
i.e	That is
ICT	Information and Communications Technology
IFSA	Islamic Financial Services Act 2013
IKP	Institusi Kewangan Pembangunan
IMFIs	Islamic Microfinance Institution
irs	Return to Scale
ITBF-*i*	Ijarah Thummal Bai 'Financing
IV	Independent Variables
JCORP	Johor Corporation
KBG	Kafalah Bank Guarantee

LM	Lagrange Multiplier
LNTA	Size of Bank
LTA	Liquidity Risk
MBN	Market Business News
MENA	Middle East and North Africa
MFIs	Microfinance Institution Conventional
MIDF	Malaysian Industrial Development Finance Berhad
MKFF-*i*	Malaysia Kitchen Financing Facilities-*i*
MP	Marginal Product
MSU	Michigan State University
MSU	Michigan State University
MTDC	Malaysian Technology Development Corporation
NPL	Non-Performing Loan
NPLTL	Credit Risk
OLS	Ordinary Least Squares
OTE	Overall Technical Efficiency
PBTB	Prudential BSN Takaful Berhad
PE	Labor
PNS	Perbadanan Nasional Berhad
POLS	Pooled Ordinary Least Squared
pp.	Pages
PUNB	Perbadanan Usahawan Nasional
R&D	Research and Development
RCB	Rural Community Bank

RDB	Regional Development Banks
RM	Ringgit Malaysia
ROA	Return on Asset
ROA	Profitability
SCC	Sabah Credit Corporation
SDB	Sabah Development Bank Berhad
SFA	Stochastic Frontier Approach
SGF	Shariah Governance Framework
SME	Small Medium Enterprise
SMI	Small and Medium Industry
SPTF	Skim Perbankan Tanpa Faedah
TE	Technical Efficiency
TFA	Thick Frontier Approach
TFP	Total Factor Productivity
TWA	Tawarruq Asset Financing
TWF	Tawarruq Financing for Fixed Working Capital
VBI	Value-Based Intermediary Concept
VRS	Variable Return to Scale

LIST OF ABBREVIATIONS

A	Research Matrix of Efficiency
B	Research Matrix of DFI
C	Research Matrix of Technical Efficiency
D	Research Matrix of Financing Structure
E	Selection of Determinants
F	Selection of Input and Output
G	Input-Output Data
H	Determinants Data
I	Data Massage for DEA Analysis
J	Data Massage for OLS Analysis
K	Result Trough Software (DEAP)
L	Result Trough Software (EViews)

CHAPTER 1

INTRODUCTION

1.1 Introduction

Development Financial Institutions (DFIs) are financial institutions that play an important role in the development of the Malaysian economy through mobilizing resources in the financial sector (BNM, 2023). In 2022, total DFIs financing recorded RM163.4 billion channeled for the socio-economic sector (BNM, 2022). This value makes DFIs remain the main credit providers for microenterprises simultaneously forming 84% of total microfinance accounts. Through this chapter, the position of DFIs will be overview in the background of the study and the efficiency gap will be seen through financial information. Followed by the objectives, research questions, hypothesis, study limitations, study framework, significance of the study and the operational definition of the study.

1.2 Background of Study

Financial performance that can be measured through financial ratios reflects the ability of an institution including DFIs in managing resources (Enad & Gerinda, 2022). However, DFIs show poor performance in the financial ratio even though they have an important role in the development of the country's economy and are even monitored by the government. Beginning in 2002, DFIs was monitored by BNM under the Development Financial Institutions Act 2002 (DFIA) as a framework for financial management of DFIs (BNM, 2002). Six institutions, namely Bank Pembangunan Malaysia Berhad (BPMB), Small Medium Enterprise Development Bank Malaysia Berhad (SME Bank), Export-Import Bank of Malaysia Berhad (EXIM Bank), Bank Kerjasama Rakyat Malaysia Berhad (Bank Rakyat), Bank Simpanan Nasional (BSN) and Bank Pertanian Malaysia Berhad (Agrobank) have been gazette as prescribed institutions under BNM (BNM, 2018).

Until now, this institution under the control of BNM should already have a good mandate achievement report to uplift the development performance of a country and build trust for internal and external stakeholders, especially in the role of Islamic finance (Shamsudin et al., 2020). Among the government's efforts is the disclosure of the Shariah compliant structure that has begun to be revealed to institutions so that it follows the needs of the community of this Islamic country since 2015. In fact, some of these institutions have gained the public's trust in Islamic products offered such as Bank Rakyat and BSN. In that case, other institutions in this group should also provide good visuals in developing Islamic-based institutions. In addition, this institution is closer to the community because they offer products for socio-economic development.

Their main role is to develop the socio-economic sector in Malaysia, or we can recognize it as underserve market by other commercial banks. This underserves market include sector of agriculture, infrastructure, small and medium enterprises, maritime, export-oriented sectors and high-technology industries where it all covers under socio-economic sectors in Malaysia (BNM, 2019). Despite having strong objectives in the economy, DFIs' contribution is still viewed as minimal in relation to other institutions and has other disputes related to its business function.

The business conducted by DFIs is seen to be similar to commercial banks where business include in home and corporate financing instead of size up in providing credit facilities and encourage underserve businesses market. This led to a press release through speech from Datuk Nor Shamsiah Mohd Yunus, governor of Bank Negara Malaysia, who suggested that DFIs need to re-engineer their business models to strengthen the business in the long run (The Edge Malaysia, 2018). Therefore, the contribution information in terms of financing will be discussed to see the real position in their development based on the previous year.

For overview of their target sectors developments, from 2014 to 2018, total financing accumulated by the DFIs show that three percent on average annual growth rate. This was observed in annual report by Bank Negara Malaysia (BNM, various year). However, the numbers are not consistent offers to the economic sector involved. For example, there has been no increase in financing over the three consecutive years (from 2016 to 2018) on the sector of electricity, gas and water supply, maritime sector, and transport, storage and communication sectors.

In contrast, the agriculture, forestry and fishery sectors are seen as the most consistent sectors to grow until 2018 (RM 11,844.8 million) with growth of 10.2 per cent compared to 2017 (RM 10,748.4 million) (BNM, various years). The sector's performance is a boost from the microfinance program launched in November 2017 for agricultural entrepreneurs in the low-income group (BNM, 2017). This growth information proves that DFIs need to actively offer comprehensive financing for all sectors depending on the role of the institution offering the product.

Another reason of the purpose from the government's proposal to re-engineer DFIs is to ensure that they no longer rely on government fiscal support. However, the aspect of their capabilities needs to be reviewed. This is because, this financial position is a measurement to ensure that DFIs are sustainable in the long run. Therefore, data on aspects of asset size, capital size, profitability and risk exposure will be seen through the current overview.

Based on the Table 1.1, the total assets of DFIs are seen to increase each year. The average growth in total assets from 2014 to 2018 was 4 percent. This value is a measure as the small size of a bank's activities which includes investment, financing, deposited placed and fixed assets. This is because, the value is far behind the commercial bank as a financial entity that generates its own income in Malaysia. Assets for commercial banks were 12 times, over RM 2 million, higher than the DFIs in the average of 2014 to 2018 (BNM, various year). This difference puts pressure on DFIs to survive in the long run as main institution that develops priority sector in Malaysia.

While equity value also measures how much a firm is worth. It is a neutral view on the pure size of an institution. In describing size of capitalization, equity is the sum of capital derived from bank owners (Schildbach, 2017). Based on equity values on Table 1.1, DFIs capital is seen to be unstable with fluctuated data from 2014 to 2018. Due to the large drop in 2015 and 2017 (11 percent in average), DFIs' capital only grew 4.5 percent annually. Besides, total equity has a lower value than total assets. It is a 12.7 percent average ratio equity to total assets per year. These small ratios (less than 70 percent) prove that DFIs are more likely to take on debt than financing their equities through assets (Michigan State University [MSU], 2011). As a result, shareholders will be exposed to risk when DFIs are forced into liquidation (Efendi et al., 2018).

Table 1.1

Total Asset and Equity of DFIs from 2014 to 2018

Items	2014	2015	2016	2017	2018
Total Asset (RM million)	264,182.7	275,000.4	286,066.5	299,786.2	308,458.1
Total Equity (RM million)	37,687.8	29,664.9	36,628.3	36,174.1	42,438.4

Note: Adapted from BNM, various years.

In addition, DFIs are no exception from risks of non-performing loan (NPL) that effect on income values. This issue has been around since the beginning year of DFIs introduced, 2002, where income from several DFIs declined following the high level of NPLs and losses in stock investment as a result of the financial crisis of 1997. Total gross NPLs for DFIs increased from RM0.7 billion to RM5.7 in 2002 and most DFIs experienced high levels of gross NPL for between 8.2 percent and 49.2 percent of total loans (BNM, various year). It seems to be worse when this value is seen to be increasing and affecting revenue to this day.

For example, of DFIs, net income for EXIM Bank shows negative numbers from 2016 to 2018 as in Table 1.2. The last increase was in 2015 at 31 percent (25 million). While BPMB Bank showed a decline in net income from latest year between 2017 and 2018 (24 percent decrease). But then, income of BPMB in 2016 showed the highest growth with a total revenue difference of RM 218 million. However, high declines are shown during the year in 2015 with a gap of RM 138 million compared to 2014. Both banks are showing inconsistency in income performance on a yearly basis. This poses a risk to the bank as net income also plays a role in measuring a bank's efficiency in managing assets (Abdul Jamal et al., 2012).

According to the Table 1.2, both banks are exposed to high NPL risk. EXIM Bank showed an increase in NPL values in 2015, 2016, and 2018. The percentage increase in 2018 (95 percent) was higher than the percentage increase in 2015 (30 percent) and 2016 (83 percent). While BPMB bank showed a decrease in 2018 at 15 percent from 2017. It is a lower than the previous year's decline (2017: 25 percent). This value of NPL also show the higher numbers than net income, which is affects the total earning year by year. Earnings are expected higher than current amount if NPL values are well controlled (The Edge Malaysia, 2018).

Table 1.2

Net Income and NPL of EXIM Bank and BPMB from 2014 to 2018

DFIs	**Items**	**2014**	**2015**	**2016**	**2017**	**2018**
EXIM Bank	Net Income (RM million)	19	25	(227)	(93)	(264)
	NPL (RM million)	727	946	1,733	1,370	2,677

(continue)

Table 2.1 *(continued)*

DFIs	Items	2014	2015	2016	2017	2018
BPMB	Net Income (RM million)	125	(13)	231	213	167
	NPL (RM million)	3000	2,794	3,623	2,706	2,277

Note: Adapted from Fitch Solutions, 2019.

In this regard, since 2015, the government has consistently made regulation to ensure the management of DFIs is in controlled and efficient. These include amendments to corporate governance, tightening the criteria for appointment of CEOs, clearer roles of the Board and ministerial accountability, promoting greater efficiency and enhancing accountability for compliance with bank-issued standards (BNM, 2015). BNM also introduces a new area of upholding Shariah compliance in the activities of DFIs (BNM, 2015). This is in line with the provisions of the Islamic Financial Services Act 2013 (IFSA). Accordingly, all institutions are seen to offer Islamic-based products and services to this day. In fact, all six institutions that have been gazette as prescribed institutions under BNM now have their own Syariah committee.

However, previous discussions show the development of DFIs is still weak in finance and risk management. Due to the lack in financial determinants, efficiency controls are necessary on the dominant indicators in DFIs. Some low performing in financial items that contribute most in DFIs performance are important to study to determine the level of efficiency in managing DFIs. This step is to ensure that DFIs are in line with the government's objectives in order for DFIs to survive in the long run. Therefore, this study will examine the technical efficiency of DFIs using Data Envelopment Analysis (DEA) involving input and output data as well financial ratios of the institutions.

1.3 Problem Statement

Preliminary reviews were made in previous studies and found repeated inefficiency problems at DFI institutions in foreign countries. For example, a study from Lutfi and Suyatno (2019) that examines Regional Development Banks (RDBs) in Indonesia is not efficient at the selected input and output levels. The same results were shown by several DFIs studied from several high-income, low-income and middle-income countries by Yuning et al. (2019). In fact, this problem statement does not seem to end when the reviews on the study of DFIs in Malaysia is carried out.

Apart from the gap in selection of the data period, the disclosure of Shariah operations is also the main factor of difference between this research and the latest study by Raj & Naseer (2015) who studied the efficiency of DFIs in Malaysia. As previously stated in the background of study, BNM introduces a new area of upholding Shariah compliance in the activities of DFIs since 2015, while the Raj & Naseer (2015) study only examines the efficiency of the bank based on data from 2006 to 2012. Therefore, this study is interested review the efficiency of DFIs with longer data periods from 2009 until 2018 where this period has involved the implementation of Shariah compliance from the government.

Based on several studies that examine the efficiency performance of Islamic banks, most of the results show a higher efficiency of Islamic banks compared to other banks. For example, the study of Bitar et al. (2019) shows that Islamic banks are more efficient than conventional banks in the Arab Spring. It was supported by Samad (2019) who studies the efficiency of Islamic banks in Bangladesh. While Basri et al. (2018)

found that domestic Islamic banks are more efficient than international Islamic banks located in Malaysia. This means that, the Shariah exposure introduced by the government to the operation of DFIs can provide new support for their performance if managed well. However, among those studies prove that the efficiency of this Islamic institution is determined through some great financial management. What if the institutions that do not have a good financial report?

Previous studies showed that the determinants of efficiency were involved by financial ratios. Most of the results indicate that a bank has a low level of efficiency when it has a low performance of financial ratio. Ramli et al. (2018) stated that domestic banks in Malaysia have low efficiency when they have a small bank size. While Yidersal and Man (2018) shows that the efficiency of owned banks in Ethiopia is low when the determinants of bank profitability are not reasonable. Then, Bitar et al. (2019) also show that efficiency of conventional banks in the Arab Spring are low with poor capital adequacy and liquidity. Finally, Tenkir and Haifeng (2020) stated that debt financing affects the level of bank efficiency in several countries.

By now, DFIs should've somehow practice optimum efficiency in operating system to achieve stable performance. This to ensure that they no longer rely on government fiscal support. However, their financial position like capitalization, liquidity risk, profitability and credit risk level are still on the decline numbers. Where these determinants affect performance of technical efficiency in many institutions proved by studies discussed before.

For example, DFIs have the capitalization issues. According to MSU (2011), any institution with a ratio of less than 70 percent, is considered at risk and may reduce its financing capacity. Thus, data from the three DFIs banks are compared. BPMB showed an average capital ratio from 2014 to 2018 was 28 percent, followed by Agrobank 19 percent and Bank Rakyat 15 percent. Meaning that BPMB, Agrobank and Bank Rakyat finance 28 percent, 19 percent and 15 percent of its assets by equity, while other 72 percent, 81 percent and 85 percent is funded by debt. This performance of capital in DFIs is considered to be low.

Then, do DFIs have a good level of liquidity risk and ability to meet its credit capacity through asset guarantee? The higher the ratio value, the better the credit performance level. However, if it is too high, it may cause a bank's liquidity problem (Rivai, 2007). In the case of DFIs, some institutions performed extremely high values such as SCC (100.4 percent) and SDB (91.9 percent) for an average in three years (2016-2018). It shows that the institution's quality assets have a limited allocation in the event of possible loss (Hassan & Bashir, 2002). This shows that the institution has problems in controlling liquidity risk.

In other situations, a liquidity ratio that is too low indicates a credit risk where the institution may be involved with a high NPL value. In this regard, several DFIs show a very low liquidity ratio which involves credit risk. Such as CGC (7.1 percent) and MIDF (16.3 percent) for an average in three years (2016-2018). The value of the ratio is too small to indicate that the institution is facing high credit risk (Dendawijaya, 2005). Thus, the stability of DFIs needs to be further explored in terms of technical efficiency.

While profitability of DFIs showing a loss digit. For example, EXIM Bank and SMEs respectively represent the value where it is RM -264 million and RM -556 million on the latest year, 2018. This in turn reflects the size of each institution being small and difficult to sustain in existing assets (Schildbach, 2017). In fact, the burden on each bank was followed by high NPLs of RM 2,677 million for EXIM banks and RM 2,006 million for SMEs. If this value can be overcome, it can change the value of the negative earnings for each of these banks (The Edge Malaysia, 2018). Therefore, the efficiency level of the DFIs should be known to evaluate the influence of profitability, size and credit risk.

As other studies, this financial determinant is influenced by the input and output of an institution. Therefore, this study is interested in examining the level of efficiency of DFIs based on inputs and outputs that are seen as relevant, i.e., inputs: fixed assets and labor as used by Thilakaweera et al. (2016) and Raéf (2017). While the output is financing as used in the study of Huichen and Yifan (2018), Faisal et al. (2017) and Velid and Nejra (2017).

However, the labor data used is focused on personnel expenses data which is also used in Huichen and Yifan's study (2018). It is because labor data has shortcomings to be measured directly because it requires detailed data such as the number of employees, working hours and detailed skills (Kato et al., 2009). In addition, throughout the observation, this combination of two inputs and outputs (fixed asset, personnel expenses and financing) has not been used in any study involving Islamic institutions. So, this gap is expected to be able to contribute to the non-parametric idea which stated

that the input is not tied to only the fixed input that will be discussed in the theoretical framework.

Until now, efficiency related studies in DFIs have been limited for reference. Although Raj and Nasser's (2015) study used the same variables and methods as this study, however the study used short and old data period. Therefore, the efficiency of DFIs is important to study using longer and more recent data since DFIs currently have low financial records. The study also used only nine selected institutions while this study will use ten selected institutions with the addition of Sabah Development Bank Berhad (SDB) institutions. Significant for this study, the level of efficiency and variables that determinants of DFIs efficiency can be a guide in the government's desire to re-engineer DFIs business. Then, several objectives and research questions will be addressed from the problem statement.

1.4 Objectives

The objective of the study is to measure the technical efficiency of DFIs. The technical efficiency in DFIs measured based on output, input and some of determinants which is brought by the problem statement. To achieve the objective, the analysis is divided into a few sub-objectives subject to DFIs:

i. To measure the level of technical efficiency through input and output;
ii. To analyze the relationship between technical efficiency and capitalization;
iii. To study the relationship between technical efficiency and liquidity risk;
iv. To identify the relationship between technical efficiency and size of bank;

v. To investigate the relationship between technical efficiency and profitability;

vi. To study the relationship between technical efficiency and credit risk.

1.5 Research Questions

Research questions are identified through the objective. To preliminary predictions on the questions, the hypothesis is developed. Thus, the questions and hypothesis on DFIs are as follows:

i. What is the level of efficiency can be determined based on input and output?

ii. Does capitalization affect technical efficiency?

iii. Does liquidity risk affect technical efficiency?

iv. Does bank size affect technical efficiency?

v. Does profitability affect technical efficiency?

vi. Does credit risk affect technical efficiency?

1.6 Hypothesis

Hypothesis are constructed to make preliminary predictions on the research questions constructed. It follows from the objectives involving input, output with technical efficiency and its determinants. The hypothesis constructed are as follows where each involves DFIs:

i. The level of efficiency can be determined through input and output;

ii. There is significant relationship between technical efficiency and capitalization;

iii. There is significant relationship between technical efficiency and liquidity risk;

iv. There is significant relationship between technical efficiency and size of bank;

v. There is significant relationship between technical efficiency and profitability;

vi. There is significant relationship between technical efficiency and credit risk.

1.7 Theoretical Framework

The theoretical framework is built to connect important factors in the study to answer the research problem through basic theories. There are theories that are often used for studies involving the level of efficiency in institutions used by previous studies. The theory is a production function which is one of the theories in macroeconomics that is also used in the study of Shima (2012), Thilakaweera et al. (2016) and Velid & Nejra (2017). Thus, this study refers to the Cobb-Douglas Production Function as the main theory explaining the conceptual framework of the study.

This theory is a basic theory that describes the relationship between inputs and outputs in an institution or organization. In explaining the relationship, the input is used as a set of institutional components to obtain the maximum number of outputs (Shima,

2012). The same concept is also explained through the DEA which emphasizes the element of ratio of weighted output to weighted input and subject to the technical efficiency. Furthermore, the DEA in its model also explains the concept of input and output orientations through return to scale. It is the same concept used in production function theory that describes the change in output based on proportional change in all inputs (Coelli, 1996). Therefore, this theory seems to be matched with methods that can achieve the objectives of the study.

However, the Cob-Douglas theory considers only two inputs, capital and labor and ignores other important inputs. This theory is also criticized by other theorists due to having an incorrect assumption of constant returns to scale (CRS). So, this theoretical framework discussion will connect some of Farrell's ideas to assume the production function. First, a parametric function. As Cobb-Douglas which focuses only on specific input data, but Farrell's idea adds an isoquant unit to the assumption of CRS to represent technology. Secondly, the idea of non-parametric piecewise-linear convex isoquant which allows an unlimited selection of inputs. It explains that the firm does not exist in full efficiency on the production function if the assumptions on the sample industry concerned are not observed. Both ideas are built so that no function point will be located to the left or below the assumption line as shown in Figure 1.1. Where x_1 and x_2 are input to produce single output represent by y. While knowledge of the unit isoquant of the fully efficient firm, represented by SS' (Coelli, 1996).

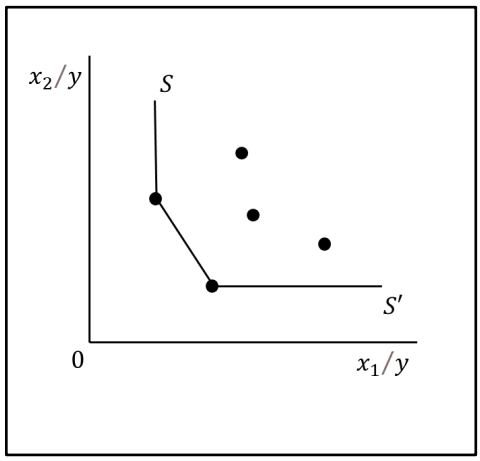

Figure 1.1. Piecewise-Linear Convex Isoquant. Adapted from Coelli, 1996

As for the appropriateness of the study, this study responds to the non-parametric idea introduced by Farrell that is not tied to input selection. However, the basic concept of production function is still used in this study. The use of diverse inputs and outputs is also a practice in current studies.

1.8 Conceptual Framework

This study will use two-stage analysis with two different research frameworks. First, this conceptual framework is to measure the level of bank efficiency based on relationship between input and output in DFIs. The variables used are fixed assets (Raéf, 2017; Thilakaweera et al., 2016) and labor (Huichen & Yifan, 2018; Faisal et al., 2017) as input, as well as total financing (Velid & Nejra, 2017; Sanderson & Alex, 2017) as output. The conceptual framework can be seen in Figure 1.2.

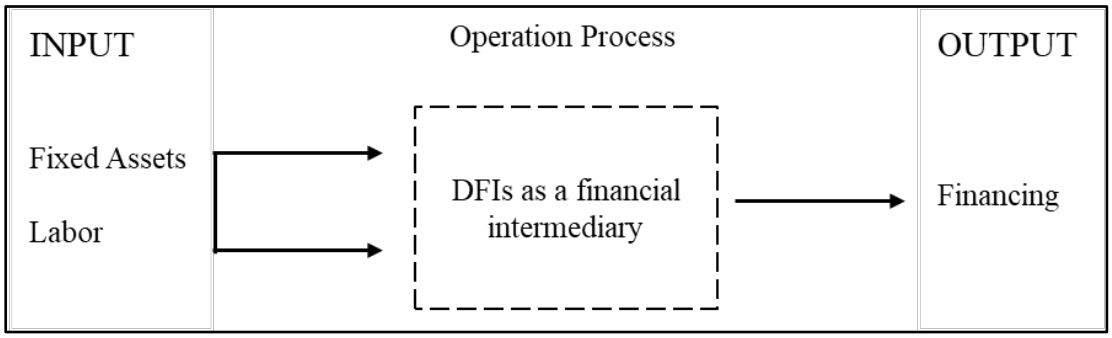

Figure 1.2. Input-Output Relationship in DFIs. Adapted from Raéf, 2017

While the second conceptual framework is relationship between the variables that determinants technical efficiency in DFIs. The variables used are total equity over total assets where proxy to capitalization (Bitar et al., 2019; Thouraya et al., 2017), ratio of loans to total asset where proxy to liquidity risk (Tadesse, 2017; Filipa et al., 2018), bank size using the natural logarithm of total assets (Dulal & Hela, 2017; Christopoulos et al., 2020), net income over total assets as a measure of profitability (Raj & Nasser, 2015; Yidersal & Man, 2018) and loan loss provision to total loans where proxy to credit risk (Eva, 2018; Anwar et al., 2018). This relationship framework can be seen in Figure 1.3.

The reference to the conceptual framework of Figure 1.3 is from the study of Raj and Nasser (2015) who also studied the efficiency of DFIs in Malaysia with the same determinants of efficiency.

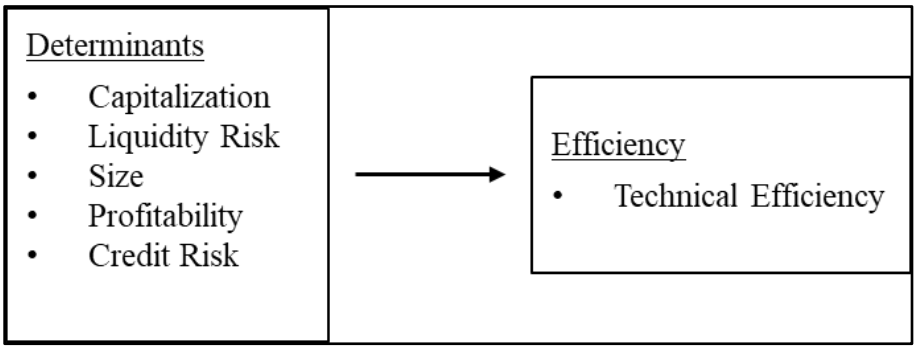

Figure 1.3. Determinants of DFIs' Efficiency. Adapted from Raj and Nasser, 2015

1.9 Limitations of Study

To make this study more focused, some limitations of the study are set as follows:

1.9.1 Limitations on Sample

DFIs have six prescribe institutions under BNM and seven non-prescribe institutions. The study will use 10 of this institution. It is including six prescribe institutional comprising BPMB, SME Bank, EXIM Bank, Bank Rakyat, BSN Agrobank. The next four non-prescribe institutions are Credit Guarantee Corporation Malaysia Berhad (CGC), Malaysian Industrial Development Finance Berhad (MIDF), Sabah Credit Corporation (SCC) and Sabah Development Bank Berhad (SDB). This study is limited to 10 DFIs because of data unavailability.

1.9.2 Limitations on Variables

Meanwhile, the two stages of analysis will use different variables. In the first stage, output and input are used to measure the efficiency level of DFIs. The inputs used are fixed assets and labor. Whereas output is total financing. In the second stage, the

variables used to determine the efficiency of DFIs are total equity by total assets where proxy to capitalization, ratio of loans to total asset where proxy to liquidity risk, bank size using the natural logarithm of total assets, net income over total assets as a measure of profitability and loan loss provision to total loans where proxy to credit risk. Variables selections are in line with previous studies that focus on the efficiency of financial institutions.

1.9.3 Limitations on Study Period

The study period is 10 years from 2009 to 2018. On this period, DFIs are expanding in offering Islamic products and services. Where important years such as IFSA 2013, involve Shariah governance in DFIs. Therefore, it is an appropriate time period to study the efficiency of DFIs. It is because, since 2014, BNM amendments in a new area of Shariah governance towards DFI Islamic product and service (BNM, 2016).

1.9.4 Limitations on Data

The data used is yearly. This study is limited to 10 years study period because of data unavailability. These data are sourced from Fitch Solutions (2019). The data includes information on bank ratios and key financials of DFIs in Malaysia. However, since the data are not provided in the difference item between Islamic and conventional, this study uses overall data as a measure.

1.9.5 Limitations on Subject of Study

The subject of this study focuses only on the technical efficiency of DFIs and the determinants of technical efficiency.

1.10 Significance of Study

This study is expected to develop a study from Raj and Nasser (2015) who studied technical efficiency in DFIs in Malaysia. Development in terms of results covers the current situation according to the latest year and covers more institutions. It is important to look at the current technical efficiency situation in DFIs so that performance can be evaluated according to the current situation. Since 2015, the government has been focusing on improving the management of DFIs in an effort to make them more Islamic. This study is likely to add to other studies like Bitar et al. (2019), Samad et al. (2019), which look at how Shariah compliant institutions operate, so it's a good idea to look into it to see if it can help us understand the current situation with DFIs better. It's also important to point out that this study that looks at technical efficiency is really important and can make a change in the institution.

Through this study, several interests can be gained through several perspectives. In terms of theory, this study is expected to contribute to Farrell's ideas that develop the Cobb-Douglas theory involving non-parametric roles. The results of this study can lead to another work using non-parametric methods that can contribute to an external understanding of the importance of the assumptions made as in other studies such as Huichen and Yifan (2018) and Eva (2018). This contribution to the non-parametric idea is developed by using different inputs and outputs from various studies.

In practice, this study is expected to benefit the government and institutions in DFIs itself. The results of this study are expected to assist the government in action to re-engineer the structure of DFIs that are far from the objective of the establishment. This can be done through more effective policy and regulation setting. In addition, the results of this study are also expected to help the management of key funds and finances in DFIs. This is important to ensure that the DFIs have a long-term strategic plan.

In terms of knowledge, this study can add a source of reference to studies on DFIs that are seen to be limited nowadays. In this regard, the study will also contribute to the study field of finance institutions in Malaysia. Besides, the institutions that this study focus was from important group for government in focusing their strategic sector of socio-economy. It is also hoped that this study will provide suggestions for future studies to improve the study's limitations. Finally, the results of this study are expected to strengthen the findings on the relationship between the technical efficiency of DFIs and the financial ratio variables of previous research.

1.11 Operational Definition

Some of the key terms in this study need to be explained more clearly by definition. The key terms that describe this study include technical efficiency and determinant of technical efficiency. Descriptions of each of the key terms in the study are as follows:

1.11.1 Technical Efficiency

Technical is being knowledgeable in a certain area, usually one that is practical, such as a mechanical or scientific field (Isman, 2012). While efficiency in term of economy can be describe as maximizing the overall or collective wellbeing of community members is the goal of economic efficiency. As read once, technical efficiency is a measure of the minimum quantity of input that can be converted to the maximum amount of output (Productivity Commission, 2013). This study interprets the technical efficiency based on how input: fixed assets and labor can explain the amount of output: financing in DFIs at the zero to hundred percent level.

1.11.2 Input

Input is a component producing output using raw materials and labor (Market Business News [MBN], 2020). In the intermediation approach, input consists of deposits, personnel cost and physical assets (Sufian, 2011). However, due to limited data for deposit, this study selected fixed assets and labor as input of DFIs. (1) Fixed Assets is a tangible asset that offers long-term financial benefits (Corporate Finance Institute [CFI], 2020). (2) Labor is a key input in the work of collecting deposits from savers to provide funds for borrowers (Sealey and Lindley, 1977). Most study using number of employees as their labor data. But data was not able over time for our study of DFIs. Therefore, this study follows Faisal et al. (2017) in using data of personnel expenses representing as labor expenses. Thus, this study define input as the total fixed assets and personnel expenses of each institution within the DFIs from 2009 to 2018. In this study, personnel expenses of each DFIs will be used to represent the labors.

1.11.3 Output

In the intermediation approach, output is a loan issued by a bank to a customer (Sufian, 2011). This study defines output as a financing from DFIs. This output is the main activity in the DFIs was to provide financing services for underserve market as a socio-economic in Malaysia.

1.11.4 Determinants of Technical Efficiency

In defining this, input and output processes are influenced by regulatory-specific variables (e.g., ownership status, geographic region and bank type) and bank-specific variables (e.g., capital adequacy, size, age, expenses and asset quality) (Nader et al., 2019). However, this study defines determinants of technical efficiency in specific variables such as capitalization, liquidity risk, bank size, profitability and credit risk as determinants of technical efficiency in DFIs. Each variable is described as follows:

a Capitalization

Capital is the margin of liquidity of the asset against the protection of the lender (Federal Deposit Insurance Corporation [FDIC], 2015). In this study, capitalization can be interpreted as liquidity margins that measured by how much DFIs are funded by shareholders' equity. Therefore, to determine a certain minimum amount of tangible equity be held against total assets, the ratio of total equity to total asset ratio in DFIs will be used. This ratio explains the ability of DFIs to repay debt if a business needs to be sold (Richard & Ronald, 1992). Capitalization reflects the survival ability of DFIs in the long run.

b Liquidity Risk

Liquidity risk refers to funding from a bank's money for loan to meet cash flow requirements (Federal Reserve Bank of San Francisco [FRBSF], 2008). This study defines liquidity risk as total asset that was source of funding that will contribute to the loans offered as cash flow requirements by DFIs. It is a ratio that shows the bank's ability to lend by using the amount of assets it has (Rivai, 2007). Therefore, the ratio of total loan to total asset will be used.

c Bank Size

It is defined as the ownership of an asset by a bank that measures the gross nominal volume of a bank's activities (Mehdi, 2018). Therefore, this study defines the size of banks based on total assets in each DFIs. Total assets are a measure of the size of banks that frequently used by regulators and many researchers. This variable is important because bank size is subject to stability risks that affect the financial market potential (Schildbach, 2017). Therefore, bank size is appropriate to determine the efficiency of DFIs.

d Profitability

This variable indicates that a bank uses its resources to generate income (L'ubica, 2007). While this study describes profitability as an indicator of the financial condition of the DFIs on its asset management. Thus, the return on asset variable is used through the ratio of net income to total asset. High- or low-income values cannot be determinants of bank efficiency (Monica, 2014). Thus, assets are use as denominator in measure the productivity of capital. Profitability is an appropriate measure for measuring efficiency.

e Credit Risk

Credit risk happen when a party that runs a contract with a bank fails to meet its requirements in accordance with agreed terms (Ken & Peter, 2016). This study defines bad loans are credit risk by DFIs where the borrower fails to repay the loan within the stipulated period. Credit risk is calculated using the NPL over total loan ratio. This ratio is important to know the level of efficiency of DFIs as the main activity of DFIs is to create credit. Therefore, credit risk will impact on each institution's main income-generating activities (Juliana, 2017). Its contribution to the level of efficiency needs to be studied.

1.12 Summary

Through the problems of the study, the relationship between the technical efficiency of DFIs with the input, output and determinants should be studied with the time period from 2009 to 2018. After observing several gaps in the study, the differences that this study has are worth studying. Where we can see a significant difference between this study and previous studies is the use of a data panel that was selected with a longer period, has an influence on the operations of DFIs that are more towards complying with Shariah nowadays and a wider selection of inputs and outputs as suggested by the assumption of non-parametric. This looks at some of the importance of the study that can benefit many parties mentioned earlier. Moreover, this study expects variable relationships based on null and alternative hypothesis. Next, in order to achieve the objectives and answer the research problems stated in this chapter, this study will

continue with the next chapter covering literature review, followed by methodology, research findings and discussion.