

AN INVESTIGATION OF EFFICIENCY AND
PRODUCTIVITY OF SELECTED SHIPPING
COMPANIES IN 5 ASEAN COUNTRIES.

BY

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ABSTRACT

Shipping companies continue to invest in efforts to improve the efficiency and productivity of sea transportation, or to maintain a highly competitive market. However, the adverse effects of the economic downturn on the global maritime industry raise questions about the sustainability of this industry. Literature has highlighted the failures of shipping companies due to insufficient working capital, high operational costs, slow recovery of shipping rates and, consequently, lost customers. These could be avoided if investment and financial operations were efficiently controlled. This research examines efficiency and productivity, which affect the operations of shipping companies. The study provides elucidation on the concepts of efficiency and productivity to benefit shipping companies, which are run with high capital and resources. Studying efficiency and productivity shows that there are many techniques for measuring and increasing efficiency, and thus productivity. In this study, the techniques most suitable for the shipping context are selected and used. This study measures the efficiency and productivity of 55 shipping companies, selected from five ASEAN nations, and includes measurement data from secondary research using quantitative techniques. Efficiency and productivity are calculated based on an output-oriented approach. To increase the efficiency and productivity of shipping companies, the author suggests reducing capital and debt expenditure. The study concludes that adoption of technology can help shipping companies improve managerial decision-making, either by adjusting operational scale or through better use of resources to suit the nature of shipping operations. The outcome of this research is a better understanding of the concepts of efficiency and productivity in the specific context of shipping companies.

خلاصة البحث

تواصل شركات الشحن الاستثمار في الجهود المبذولة لتحسين كفاءة وإنتاجية النقل البحري، أو للحفاظ على سوق تنافسي للغاية. ومع ذلك، فإن الآثار السلبية للانكماش الاقتصادي على الصناعة البحرية العالمية تثير تساؤلات حول استدامة هذه الصناعة. سلطت الدراسات الأضواء على فشل شركات الشحن بسبب عدم كفاية رأس المال العامل، وارتفاع تكاليف التشغيل، وبطء استرداد أسعار الشحن، وبالتالي فقد العملاء. يمكن تجنب ذلك إذا كان يتم التحكم بكفاءة في الاستثمار والعمليات المالية. لقد سعى هذا البحث إلى دراسة الكفاءة والإنتاجية، مما أثر على عمليات شركات الشحن لغرض هذه الدراسة. لمعرفة مفاهيم الكفاءة والإنتاجية، وفوائد شركات الشحن، لأن شركات الشحن تدار برؤوس أموال وموارد عالية. توضح دراسة الكفاءة والإنتاجية أن هناك العديد من التقنيات لقياس وزيادة الإنتاجية. لذلك، تختار هذه الدراسة بعناية الأنسب لوضع الشحن. تقيس هذه الدراسة الكفاءة والإنتاجية في 55 شركة شحن، وتم اختيارها من خمس دول آسيان. يتضمن هذا البحث بيانات القياس من التقنيات الكمية باستخدام البحث الثانوي. هذه الدراسة قد حسبت الكفاءة والإنتاجية على أساس النهج الموجه نحو الإخراج. من أجل كفاءة وإنتاجية شركات النقل البحري المتزايدة، تقترح هذه الدراسة تخفيض نفقات رأس المال والديون. وخلصت هذه الدراسة إلى أن تبني التكنولوجيا يمكن أن يساعد شركات الشحن على تحسين عملية اتخاذ القرارات الإدارية، إما عن طريق ضبط النطاق التشغيلي أو الاستخدام الأفضل للموارد اعتمادًا على عمليات الشحن. ويتم توضيح آثار هذا البحث من خلال فهم أفضل لمفاهيم الكفاءة والإنتاجية لشركات الشحن.

APPROVAL PAGE

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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This thesis is dedicated to my late father for laying the foundation of what I turned out to be in life.

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After completing my Diploma in 2001, my main concern and focus was career development. I worked hard to gain professional qualifications. I did not feel any regret about not furthering my studies until later in life, when experience had taught me that the demands of academic studies were crucial in order to progress further.

With strong support from my spouse, I began taking steps toward achieving higher academic qualifications. I struggled through re-opening the books, reading and interpreting theory, and successfully obtained my master's degree. I discovered one important lesson during my master's studies: the mind is like a plant; it requires water, nutrients, and daily sunlight to remain alive. We supply the blood (water) and the nutrients (oxygen), but we ignore the need for knowledge (sunlight) daily. This is why I decided to pursue my doctorate studies immediately after completing my master's degree, without any further postponement.

Drawing on the knowledge obtained from my master's degree and throughout the coursework of the doctorate programme, I have reached this phase. The topic of this study was based on two primary criteria: it should extend my expertise and my involvement. Since completing my undergraduate studies, I have been involved in the marine engineering field and I am very interested in econometric approaches. Thus, this thesis will represent my combined theoretical knowledge and practical experience. I would not be able to make out this thesis if I not been guided or coached. For that, I express my deepest gratitude to those who stood beside me whenever needed.

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LIST OF ABBREVIATIONS

ASEAN	Association of Southeast Asian Nations	MPI	Malmquist productivity index
BCC	Banker, Charnes, Cooper	PTE	pure technical efficiency
CCR	Charnes, Cooper, Rhode	PECH	pure technical efficiency change
DEA	data envelopment analysis	SE	scale efficiency
DWT	deadweight tonnage	SECH	scale efficiency change
EFFCH	technical efficiency change	TE	technical efficiency
e.g.	for example	TECH	technological change
et al.	others	TEUs	Twenty-foot units
FDI	Foreign direct investment	TFPCH	total factor productivity change
GDP	Gross domestic products	UNCTAD	United Nations Conference on Trade and Development
		YoY	year-over-year

CHAPTER ONE

INTRODUCTION

Business failure during economic crisis is an ongoing global phenomenon. One common reason for business failure is managerial errors and misjudgment, which can affect large multinational companies (Yap, Munuswamy & Mohamed, 2012). The Association of Southeast Asian Nations (ASEAN) was the area most affected by the Asian financial crisis of 1997–1998 (Choy, Munusamy, Chelliah & Mandari, 2011) and this situation was further deepened by the global economic downturn in 2008, challenging the sustainability of the global shipping sector (Grama, 2012). Therefore, the focus of this dissertation is on the shipping sector in ASEAN-5, which includes Indonesia, Malaysia, the Philippines, Singapore, and Thailand (International Monetary Fund, 2018). This research aims to increase knowledge of production to improve the efficiency and productivity of the shipping sector for ASEAN-5 countries using the profit-maximising approach.

1.1 BACKGROUND OF RESEARCH

The focus of this research is ASEAN-5, which consists of five developing economies (with the exception of Singapore, which has been classified as a developed economy since 1997). For several years, the ASEAN-5 economy has pursued a development strategy led by exports and direct foreign investment (Afzal & Lawrey, 2012). However, per capita gross domestic product (GDP) for ASEAN fell twice, during the Asian financial crisis of 1997–1998 and then again following the global financial crisis in 2008 (ASEAN Secretariat, 2018a). Economic expansion and contraction has a

significant effect on the performance of shipping companies (Kang & Kim, 2017), which must increase efficiency and productivity to survive economic fluctuations.

Increasing efficiency is one of many possible ways to avoid shipping company failures as a result of negative externalities, such as large investments and competitive markets (Arvidsson, 2011). For example, one of the largest container shipping lines, Hanjin Shipping, declared bankruptcy in 2017 (Hand, 2017). The main reasons for the company's failure were insufficient working capital, high operational costs, slow recovery of shipping rates and, consequently, loss of customers (Song, Seo, & Kwak, 2018). Hanjin Shipping's bankruptcy could have been avoided if it had efficiently controlled financial investment and operations.

Mergers, acquisitions, or more aggressive and larger scale alliance formation are three alternative options available for shipping companies seeking to avoid bankruptcy (Song et al., 2018). China Cosco Shipping and Ocean Network Express is a new shipping company recently formed through merger and acquisition activities (DHL Global Forwarding, 2018). However, the process of combining or forming an alliance is not simple. The greatest challenge is in understanding the differences in efficiency between shipping companies (Huang, Chao, & Chang, 2017). Efficient shipping companies with high capacity and low leverage are able to form better alliances.

The motivation for this study is threefold: 1) to understand the current efficiency and productivity at selected ASEAN-5 shipping companies; 2) to assess, validate, and compare the efficiency and productivity of the selected shipping companies; and 3) to make recommendations for how to increase financial and operational efficiency for those companies.

1.2 PROBLEM STATEMENT

Developing economies, such as ASEAN-5 countries, prefer international trade in primary commodities as a way to improve their macroeconomic stability, and shipping companies play an important role in all economies in this sense. However, the survival and sustainability of a shipping company is driven by global economic stability. Because sea transportation industry is a highly volatile industry, and income, investment, and return on capital are cyclical and come in ‘waves’, the efficiency and productivity of shipping companies are particularly important.

1.3 PURPOSE OF THE RESEARCH

The aim of this research is to explore the concept of operational sea transportation efficiency and how it affects shipping companies’ productivity. The focus is on selected sea transportation providers in ASEAN-5 and their performance from 2014 to 2018.

1.4 RESEARCH QUESTIONS

To achieve the purpose of this thesis, a series of research questions and sub-questions are posed. The background to the formulation of these questions is explained in the methodology chapter. The main questions and sub-questions are stated below:

- 1) How did the selected ASEAN-5 shipping companies conduct sea transportation operations from 2014 to 2018, in terms of efficiency and productivity?
 - a. What parameters can be used to measure the efficiency and productivity of shipping companies?
 - b. How many shipping companies are operating from ASEAN-5?

- c. How many of these shipping companies (as identified in Q1b) have valid data for the period 2014 to 2018?
 - d. How did the selected shipping companies perform from 2014 to 2018?
- 2) How could the selected ASEAN-5 shipping companies improve their technical efficiency?
 - a. What causes inefficiency in the selected shipping companies?
 - b. How much improvement in resources is needed by the selected shipping companies to maximise their output?
- 3) What is the difference between efficiency and productivity?
 - a. What is the relationship between the efficiency parameters?
 - b. How does efficiency affect productivity?

1.5 RESEARCH OBJECTIVES

The main objective of this study is to investigate the efficiency and productivity of selected shipping companies in ASEAN-5, and then to examine the factors that drive inefficiencies in performance. Consequently, several recommendations for increasing efficiency can be suggested. The sub-objectives are as follows:

- 1) To evaluate the efficiency and productivity of the sea transportation industry to understand how shipping companies' operational efficiency is affected.
- 2) To examine ways to improve the technical efficiency of the sea transportation industry via a yield maximising approach.
- 3) To compare and understand the difference between efficiency and productivity and outline specific effective management approaches for the ASEAN-5 sea transportation industry.

1.6 SCOPE OF THE RESEARCH

The area under study is ASEAN-5 (Indonesia, Malaysia, Philippines, Singapore, and Thailand). This study will focus on the efficiency and productivity of selected shipping companies in this region, as shipping companies are the main resource for seaborne trading of large commodities in any economy. The scope of this study is limited to active shipping companies that have valid data for the 2014–2018 period and are operated from ASEAN-5 nations.

1.7 JUSTIFICATION OF THE RESEARCH

Scanning of related studies revealed that much research has been conducted on the efficiency and productivity of the sea transportation industry, focusing on, for example: the efficiency and productivity of large logistics providers in Korea (Park & Lee, 2015); the relative efficiency of shipping companies (Panayides, Lambertides & Savva, 2011); the relative efficiency of maritime firms, drawing on evidence from container lines (Panayides & Lambertides, 2011); a performance evaluation model for the supply chain of a shipping company in Iran: an application of the relational network DEA (Omran & Keshavarz, 2015); 5) measuring the efficiency of maritime transport companies (Kang & Kim, 2017). However, none has looked at newly industrialised economies, specifically ASEAN-5.

ASEAN-5 has been chosen as the focus of this research because of its strategic location in the dynamic Asian region, with strong economic growth and good macroeconomic fundamentals. Although ASEAN-5 is a newly emerging and developing economy (with the exception of Singapore), commodity trading is more competitive than in developed economies such as the United States, Japan, and the European Union (Ha, Chung & Seo, 2016).

Commodity trading in ASEAN-5 involves the use of sea transportation and services. Demand for sea transportation is affected by the business cycles of economic expansion and contraction, and thus fluctuations in the business cycle directly impact shipping company revenues (Kang & Kim, 2017).

Given the importance of this sector for international trade, all key stakeholders in shipping will have a direct interest in a better and deeper understanding of the performance and efficiency of shipping companies (Panayides & Lambertides, 2011). This study aims to reduce the risk of bankruptcy and recommend a competitive strategy to deal with the uncertainty of the business cycle, ultimately improving the efficiency of shipping companies in ASEAN-5.

1.8 ISSUES AND LIMITATIONS OF THE RESEARCH

The main limitation of this research is that it considers ASEAN-5 as the only economies with large sea transportation sectors, and the analysis and recommendations are based on this assumption. This fails to take into consideration other developing countries in ASEAN, which also contribute to and influence the sea transportation sector. Furthermore, only data available on either the company's website or from the exchange platform was used, which assumes the economic/financial indicators are homogeneous at the country level. Data collection was also limited in a number of ways. It was difficult to retrieve historical data because the reporting formats and units differ over time, and vary at the company and country level. In addition, during the period 2014–2018, several shipping companies joined or formed new alliances, which may have influenced their sustainability.

1.9 SIGNIFICANCE OF THE RESEARCH

By studying shipping companies' efficiency and productivity, this study can compare and understand the differences between these two levels and outline effective management approaches specific to the shipping sector. The study demonstrates what change is needed for specialised shipping companies to reach optimal technical efficiency, through actual cases of selected shipping companies in ASEAN-5. The ability to quantify change and improve performance can facilitate managers and shipowners in designing more effective investment strategies. This study also provides the relevant understanding of the different characteristics of shipping companies and knowledge of how various operational factors influence efficiency and productivity, policymakers can design more effective regulations.

1.10 CONTRIBUTION OF THE RESEARCH

In addition to contributing to the public policy debate, this research is also important in two other respects:

- 1) The main contribution of this study lies in the fact that, to date, benchmarks for efficiency and productivity in shipping companies in ASEAN-5 have not been examined using data envelopment analysis (DEA) and the Malmquist productivity index (MPI) approach.
- 2) A secondary contribution of the dissertation is to the maritime literature. Until now, other sectors of the maritime industry (e.g., ports, terminals, shipyards, and logistics) have been analysed using DEA techniques. The analysis in this study expands on this.

1.11 EXPECTED OUTCOME OF THE RESEARCH

Based on the motivation of this study, specific research questions will be answered through the following research efforts:

- 1) Documentation of the practices of efficiency and productivity by the selected ASEAN-5 shipping companies, including a list of shipping companies that are publicly traded in ASEAN-5.
- 2) Validation and benchmarking of the selected ASEAN-5 selected shipping companies.
- 3) Putting forth recommendations for increasing shipping companies' efficiency and productivity in ASEAN-5.

1.12 OUTLINE OF THE RESEARCH

This dissertation is organised into five chapters.

- 1) Chapter One provides an overview of the industry and states the importance of the research.
- 2) Chapter Two reviews the empirical maritime literature and theoretical and empirical literature related to estimation of inefficiencies.
- 3) Chapter Three presents the methodology, data collection, and approach limitations.
- 4) Chapter Four provides parameter estimates, including estimating inefficiencies and examining the relationship between subsidies and other explanatory factors and inefficiencies.
- 5) Chapter Five presents the conclusions and discusses directions for future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter provides an overview of previous research on efficiency and productivity. It then introduces a framework for the case studies that represent the main focus of the research described in this dissertation.

ASEAN-5 has been chosen as the focus of this research because of its strategic location in the dynamic Asian region, with strong economic growth and good macroeconomic fundamentals. The aim is to improve the financial efficiency and productivity of ASEAN-5 shipping companies. Figure 2.1 describes the literature review agenda and process, including literature on definitions, study areas, sea transportation, and analyses of economic performance.

Definition	Study Area	Sea Transportation	Economic Performance
• General • Type of efficiency • Type of productivity	• Demography • Socio-economic • Maritime activities	• Operation • Functions • Market Structure	• Sea Transportation Industry • Variables • Estimation

Figure 2.1 The literature review agenda

2.2 DEFINITION

2.2.1 General

The concepts of efficiency and productivity are frequently confused and the terms are often used interchangeably, yet they are not the same. Efficiency is a measurement of the possibility of production for companies that have comparable input values (Battese & Coelli, 1988), while productivity is the ratio of measured output to input. Equations 2.1 and 2.2 below simplify the definitions of efficiency and productivity.

$$Productivity = \frac{Outputs}{Inputs} \quad (2.1)$$

$$Efficiency = \frac{\text{Firm's production ratio}}{\text{Industry's best production ratio}} \quad (2.2)$$

To illustrate the difference between efficiency and productivity, the production of three companies is plotted in Figure 2.2. The productivity ratio for Companies A and C is 1 (based on Equation 2.1), while for Company B it is 0.5. Company B can thus be deemed inefficient compared to the other two companies. In order for Company B to become efficient, it must double productivity.