

**EFFICIENCY ANALYSIS OF COBB-DOUGLAS
PRODUCTION FUNCTION IN KOJA
CONTAINER TERMINAL, TANJUNG PRIOK
PORT**



Bachelor Thesis

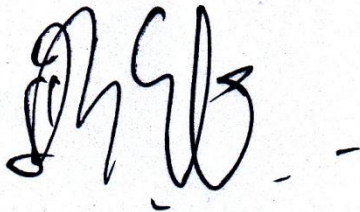
Submitted as Partial Fulfillment of the Requirements for the Undergraduate
Degree (S1) of Economics in Faculty of Economics and Business

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APPROVAL STATEMENT

It is hereby certified that I have read this undergraduate thesis entitled “**Efficiency Analysis of Cobb-Douglas Production Function in Koja Container Terminal, Tanjung Priok Port**” by Maharani, and in my opinion it is satisfactory in terms of the scope, quality, and presentation as a partial fulfillment of the requirements for undergraduate degree in Economics.




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CERTIFICATION OF EXAMINATION

I certify that the board of examiners have met on Monday, November 9th, 2015 to conduct a final examination of this candidate on her undergraduate degree and recommended that the candidate be awarded the relevant degree.



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Declaration

To the best of my knowledge and belief this undergraduate thesis contains no material previously published by any other person except where due acknowledgment has been made.

This bachelor thesis contains no material, which has been accepted for the award of any degree or diploma in any university.

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Abstract

Container terminal efficiency and productivity is important issues since productivity of container terminal in Indonesia is the low but the total handling charge is relatively high compared in ASEAN. When productivity low while total handling charge is high, it reflects the inefficiency of input in production process, so the efficiency could be improved to meet the international requirements. This study was using Cobb-Douglas Production Function to analyze efficiency of Koja container terminal in the period 2010-2014, and Herfindahl-Hirschman Index (HH Index) and Shift Share Analysis to analyze the output share of Koja container terminal to Tanjung Priok Port. The results of this study shows that the inconsistent the assumption of Cobb-Douglas Production Function in Koja container terminal. This study also finds out that technological progress is a main contributor in container throughput growth. Finally, the market structure is oligopoly which concentrated in two terminals. The conclusion of this study is technological has an important role to increase the efficiency of the container terminal in order to compete in market. Terminal operator is advised to improve the quality service in handling process and necessary creates good governance to develop the port activities. The limitation of this study is the lack of data that makes this variable using proxy so it can not explain the overall situation. Moreover, using ordinary least square can not accommodate to decompose the total factor productivity, the best methods to decompose TFP is using Stochastic Frontier Analysis (SFA).

Keywords: Efficiency, Cobb-Douglas Function, Returns to Scale, Technological Progress, Output Share, Throughput

JEL Classification: C6, F3, O3, R4

Abstraksi

Produktivitas dan efisiensi terminal peti kemas di Indonesia yang rendah merupakan isu utama dikarenakan biaya yang ditetapkan tinggi dibandingkan negara di ASEAN. Hal tersebut menunjukkan bahwa telah terjadi inefisiensi penggunaan input di dalam proses produksi. Oleh karena itu, efisiensi terminal peti kemas perlu ditingkatkan. Studi ini menggunakan fungsi produksi Cobb-Douglas untuk menganalisis efisiensi Terminal Peti Kemas (TPK) Koja periode 2010-2014, dan Herfindahl-Hirschman Index serta analisis shift-share untuk menganalisis kontribusi output TPK Koja terhadap pelabuhan Tanjung Priok. Hasil studi menunjukkan bahwa telah terjadi inkonsistensi asumsi dari fungsi produksi Cobb-Douglas apabila diterapkan di TPK Koja. Studi ini juga menunjukkan bahwa perubahan teknologi sangat berperan dalam meningkatkan output. Selanjutnya, struktur pasar di Pelabuhan Tanjung Priok adalah oligopoly yang terkonsentrasi pada dua terminal. Kesimpulan dari studi ini adalah peranan teknologi sangat penting untuk meningkatkan efisiensi terminal peti kemas agar berdaya saing. Operator terminal diharapkan mampu meningkatkan kualitas pelayanan dalam proses bongkar muat dan membuat tata kelola perusahaan yang baik agar aktivitas pelabuhan semakin berkembang. Keterbatasan dalam studi ini berkaitan dengan data yang mengakibatkan penggunaan proksi dalam pengukuran variabel, sehingga belum mampu menjelaskan kondisi secara keseluruhan. Selain itu, penggunaan model OLS tidak mampu mendekomposisi total faktor produktivitas, alat analisis terbaik yang digunakan untuk mendekomposisi total faktor produktivitas adalah analisis stokastik frontier (SFA).

Kata kunci: Efisiensi, Fungsi Cobb-Douglas, Returns to scale, Technological Progress, Kontribusi output, Throughput.

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CHAPTER I

INTRODUCTION

1.1 Background

The fact that port activities encourage international trade has led to the increasing process of containerization of freight and global value chain. Meanwhile, maritime transport, as a dominant mode, provides low cost, efficient and environmental friendly of transportation (Brooks, 2000). The international trade volume carried through seaport is more than 90% and the port traffic increases 3 percent on average per year (International Maritime Organization, 2009). Therefore, ports should be regarded as an important component since supply chain and logistic affect national competitiveness, and it deals within the overall production and distribution process (Bichou & Gray, 2004; Wang & Gao, 2012; Razzaque, 1997). Ports not only function as trade facilitator, but they also provide direct access shipping from domestic trades to the rest of the world (Haynes, Hsing, & Stough, 1997).

In the past few decades, port has an evolution on its function and container ships. The evolution of port's function takes place in three generations: before 1960 (first generation), in 1960s (second generation) and after 1980 (third generation), (see appendix 1). Nowadays, the third generation of ports have been designated more complex that is being developed from production to distribution networking at an international level.

Strategy for the development of the ports may concern as logistic center and chain of the world trade communication that cover activities that are more

complex; such as logistic activities, forming terminals and distribution centers. Moreover, the establishment of port collaborative system concern about the relationship between port and related industries. Therefore, managerial views this generation of ports from passive to active role of collaboration with world trade process.

Meanwhile, the performance of the port depends on the efficiency of the distribution as the most influence factor of competitiveness. As a consequence, the efficiency level of the port and its performance is a factor that should be considered crucial. This has been sufficiently established by the fact that inefficiency can generate domino effect on supply chains (Kennedy, Lin, Yang, & Ruth, 2011), and the level of efficiency and performance determine to international competitiveness (Lee, Chou, & Kuo, 2005). Port performance has a significant role to evaluating production because it can define the system of operational both now or the future (Dyson, 2000). Under this circumstance, port authorities are driven to create better value, and have tried to improve their facilities and system.

In Indonesia, port authorities are under Indonesian Port Company (IPC), a state owned company under the Ministry of State-owned Enterprise. Indonesia Shipping Law (UU No 21/1992) stated that the port authorities is under the IPC. The IPC has a huge role in controlling the operation, which is divided into 4 operational areas. Belawan Port (North Sumatra), Tanjung Priok Port (Jakarta), Tanjung Perak Port (East Java), and Makassar Port (South Sulawesi) are headquarters of IPC I, IPC II, IPC III, IPC IV. In addition, several ports have

cooperation with private sectors to increase their scale of operation, as (Notteboom T. , 2007; Shaw, Gwilliam, & Thompson, 1996) concluded that privatizing port allows greater flexibility and efficiency in market and quick respond to changes in the economic environment. One of top three private Global Terminal operators, Hutchinson Port Holding (HPH) whose world market share is approximately 7.2% has invested to operate Tanjung Priok Port and Tanjung Perak Port.

The role of the port as an economic triggering activities has been realized; however, ports suffer from a number of problems including geographic constraint, lack of security, corruption, lack of infrastructure, and asymmetric information, main problem is port in Indonesia are monopoly has led to the inefficient management and bureaucratic administration (Cullinane, Song, & Gray, 2002).

Lack of competition among ports in Indonesia creates IPC to get no incentive to improve their services and investments ro developed sophisticated equipment or in dredging. For example, depth dredging appears to be a major problem in almost all ports in Indonesia. Vessels often have to wait that leads to highly waiting time when the depth is not possible to loading. Moreover, several regional ports have problems with container facilities; only 16 out of the 111 commercial ports have container-handling equipments.

Other cause of corruption related to inefficiency of port such as berth assignment takes place in some practices that related to negotiation of import and export procedures. Cargo shipment from Indonesia typically attracts a 30-40 percent premium insurance to cover piracy at sea and port based activities of

organized crime groups. Lack of integration among related institutions to carry out activities in port creates asymmetric information that provides an opportunity to do corruption. Therefore, bureaucratic reform and restructuring of the port are required for port planning (Parkash, 2005; Haralambides, Cariou, & Benacchio, 2002).

Bureaucratic reform and restructuring of the port is essential regarding that Indonesia might be able to obtain a huge opportunity if port authorities could exploit its potencies. Considering its geographic position, Indonesia has a strategic position that provides comparative advantages; it is due to lying between two oceans and two continents. As a result, that approximately 70 percent of shipment from Europe, Middle East, and South Asia to Pacific relies on Indonesia's sea. Consequently, it is imperative to put emphasis on establishing highly performance ports spread over the entire region of Indonesia. Enhanced port efficiency tends to reduce market price due to decreasing logistic cost and helping to ensure the national's product to be more competitive in the world market. Therefore, if Indonesian container terminals develop to be efficient ones, Indonesia's port might be improving to be a hub port and giving the domino effect to the national economy.

United Nation Conference Trade and Development suggests two categories of port performance indicators; (1) macro performance indicator to measure the impact of port activities to the national economy, and (2) micro performance indicator to evaluate operation in port level. In recent years, port performance has been evaluated by measuring productivity indicator (Frankle,

1991), calculating cargo-handling productivity at berth (Bendall & Stent, 1987), evaluating by single factor productivity (Kim & Sachish, 1986; De Monie, 1987), comparing actual throughput with optimal throughput over time (Talley W. K., 1988), evaluating port performance efficiency after port reformation (Okeudo G. N., 2013), and assessing the influence of administrative and ownership structure (Cullinane, Song, & Gray, 2002).

To evaluate the port performance properly, several methods have been suggested, such as estimation using production function and cost function. Many researchers have evaluated the performance using Data Development Analysis and Stochastic Frontier Analysis (Roll & Hayuth, 1993; Lee, Chou, & Kuo, 2005). In special case, Bayesian Stochastic Frontier to measure the relative efficiency is also applied (Notteboom & Broeck, 2000).

1.2 Statement of the Problem

Realizing the strengths and weaknesses of the port's performance in Indonesia, efforts to improve its performance to be more efficient and effective should be put into consideration by both government and private sectors. Geographically, ports in Indonesia have many advantages to take over the role performing by other ports abroad. However, the fact that the performance of some ports in Indonesia still below expectation has to be considered the most important issue.

The following data show the comparison among ports in ASEAN in 2009 in term of their THC, CHC, and productivity as shown in table 1.1.

Table 1.1: Comparisons of THC and CHC, Productivity in ASEAN Port

Asean Port	CHC (US\$)		THC (US\$)		Productivity/ Hours
	20 feet	40 feet	20 feet	40 feet	
Bangkok Port	19.53	33.21	63.48	73.25	25-30
Laem Chabang	26.86	40.78	63.48	73.25	25-30
Tanjung Pelepas	50.35	75.53	78.18	116.60	25-28
Port Klang	61.01	91.51	88.86	132.63	20-25
Singapore	88.56	129.89	107.45	159.41	25-30
Indonesia	93	150	150	230	18-20

Source: Ministry of Transportation, Republic of Indonesia (2009)

From efficiency and performance points of view, Indonesia does not have a port as a primary International port (hub port) that is capable of accommodating large trans-oceanic vessels, as opposed to the Port of Singapore. In 2009, THC in Indonesia reached US\$ 150 for 20 feet container (Table 1.1). The fact is that with high charges low productivity, the average Berth Occupancy Ratio (BOR) of 60%, indicated that a long time vessels berthed at port, is relatively high compare to Port Klang, Malaysia, around 35%. The average dwelling time is 5.5 day while that of Singapore port is 1.5 day, Hongkong Port is 2 day and Port Klang Malaysia is 4 days. Inefficiency in Indonesian port has led to the higher logistic costs that comprise 14% of the total production cost; meanwhile, Japan is only 5%. In GDP, logistic cost is accounted 24% of the total; while, in China is 18.1% and US is 10.2% of the total GDP. Therefore, the problem statement in this study, developed based on the existing condition, is that the efficiency of Koja container terminal might be improved to meet the international requirements.

1.3 Objective of the Study

Realizing the complexity of the problems, this study set an aim to investigate the performance of Koja container terminal in order to improve its efficiency and

market share. To achieve this aim, three specific objectives are formulated. The specific objectives of this study are:

1. to describe the economics activities of Koja Container Terminal
2. to analyze the efficiency of Koja Container Terminal
3. to analyze the output share of Koja Container Terminal to Tanjung Priok Port

1.4 Significance of the Study

Indonesia has launched a policy to maintain and manage the potencies of sea as one of the important source to support its economic development. Therefore, optimizing the performance of container terminals is essential in regard that geographically, politically, and economically, Indonesian's position provide many advantages. Moreover, as undergraduate student of Economic and Business Faculty of Diponegoro University it is my obligation to contribute an idea that might help improve the performance of Koja container terminal by investigating its current situation from the perspective of the effectiveness and efficiency of the management to maintain the operation activities.

To assess the efficiency of container terminal, most scholars used Stochastic Frontier Analysis (SFA). However, as Koja container terminal has a specific characteristic, Cobb-Douglas function was chosen to investigate its performance. The implementation of Cobb-Douglas function seems to be applicable because the management of Koja container terminal is a joint operation between Indonesia and Hongkong that will keep the operational data in secret.

Therefore, this study contributes an idea to the development of efficiency analysis.

1.5 Organization of the Thesis

This study consists of six chapters elaborated as follows: Chapter I, introduction, covers research background, statement of the research problem, objectives of the study, and significance of the study. Chapter 2 presents a review of theoretical literature and empirical study related to the study. Meanwhile, Chapter 3 discusses methodology used to analyze primary and secondary data. In chapter 4, a general description of the Koja container terminal is elaborated in detail. Chapter 5 presents the result of the study and its detailed explanation. Finally, chapter 6, concludes the study, discuss the policy implication. Limitation of the study and focus for the future research are also presented in this chapter.