CrossMark

Technical Efficiency Analysis of Container Terminals in the Middle Eastern Region

Ebrahim Sharaf ALMAWSHEKI[a] , Muhammad Zaly SHAH[b]

[a] *Ph.D. Candidate, Universiti Teknologi Malaysia UTM,Malaysia, E-mail:almawsheki.e.s@gmail.com (First and Corresponding Author)*
[b] *Associate Professor, Universiti Teknologi Malaysia UTM,Malaysia, E-mail:b-zaly@utm.my (Co-Author)*

A B S T R A C T

Despite an increasing number of studies on the efficiency of container terminals, their focus has mostly been on advanced and emerging markets. There are limited studies on container terminals in developing countries such as those of the Middle Eastern region, which are located in a critical geographic position in the international maritime route between the East and the West. Information on their potential for development relative to other terminals worldwide is thus not readily available. This study aims to evaluate the technical efficiency of 19 container terminals in the Middle Eastern region. The DEA approach is used to measure technical efficiency, and slack variable analysis identifies potential areas of improvement for inefficient terminals. The results show that the Jebel Ali, Salalah and Beirut container terminals are the most efficient terminals in the region, and that the least efficient is the terminal in Aden. The results provide valuable information for terminal managers, helping to develop resource utilisation for steady development in operational efficiency.

1. Introduction

Ports are the backbone of international trade; over 90% of worldwide trade is moved by sea transport (UNCTAD, 2012). This is driven by the globalisation of the world economy. The current outlook and the increasing globalisation of economies call for higher efficiency from all actors in the transport sector, especially ports, where there is massive public input in their production processes (Bergantino et al., 2013). Seaport authorities have increasingly been under pressure to improve efficiency by ensuring that services are provided on an internationally competitive basis. The efficiency of ports is an indicator of a country's economic development (Liu, 2008), and thus monitoring and comparing one port with other ports in terms of their efficiency has become an essential part of microeconomic reform programmes in many countries (Jiang and Li, 2009).

Eighty percent of seaborne cargo is moved in containers (Ramani, 1996). This confirms the importance of maritime trade by containers (Cho, 2014). Improvements in the efficiency of container ports are therefore needed. An efficient operational system can help significantly in making the best use of container port resources and infrastructure (Vacca et al.,

2010).

Efficiency plays a key role in container port competition (Yuen et al., 2013, Luo et al., 2012, Tongzon and Heng, 2005), and therefore, the analysis of container port efficiency is important for the survival and competitiveness of the industry (Cullinane and Wang, 2006). In this context, not only can such an analysis provide a powerful management tool for container port operators, it also constitutes important input for informing regional and national container port planning and operations (Verhoeven, 2010).

An extensive review of previous studies related to container port efficiency shows that the majority of studies are focused on European countries, and are limited studies that focus on Asian countries. Munisamy and Jun (2013) confirm that the majority of research concentrates on the efficiency of container ports in European countries.

Only two studies have focused so far on the efficiency of container terminals in the Middle Eastern region, those by Al-Eraqi et al. (2008) and Al-Eraqi et al. (2010). It is thus important to study the Middle Eastern region, as the container terminals in this region are located at a critical geographic position in the international maritime trade route between the East and the West. These terminals are central terminals, in which goods transferred between Europe and the far East/Australia are exchanged and transshipped to terminals in the Middle East (Al-Eraqi et al., 2010). These terminals play an important role in the region's economic development.

One of the reasons for the limited region-specific Middle East analysis to date has been a scarcity of data resulting from the political issues, security situation, and lack of transparency in government sectors. This study thus used various data sources and crosschecked the information provided by each port to make sure the data was accurate. In an effort to fill existing gap, this study aims to evaluate the technical efficiency of container terminals in the Middle Eastern region.

This study contributes to the field of transport economics by providing empirical evidence on container terminal efficiency in the Middle East region. The findings will also provide valuable guidance for terminal operators. The methodology adopted for this study was data envelopment analysis (DEA), which is frequently used to assess the efficiency of container terminals.

2. Literature Review

A study of the efficiency of the port sector first appeared in academic journals in 1993, reported by Roll and Hayuth (1993) who used DEA to assess the efficiency of 20 ports. Since then there has been a good number of studies on port efficiency, demonstrating a growing interest in methods to measure their efficiency (Pallis et al., 2011).

Based on efficiency scores for ports, previous studies had dissimilar results and conclusions; some showed high scores and others showed low efficiency scores. This raises the question of "whether there is something wrong with the techniques used or simply whether something is not captured by the existing studies" (Bichou, 2012). In fact, empirical estimations of port efficiency differ across many factors, including the method used for measuring efficiency, the type of data (inputs/outputs variables) and the region or country in which ports are located (Odeck and Bråthen, 2012).

Ports are complex organisations where multiple activities take place, with a large variety of agents, including port authorities, tugboats, consignees, and stevedores. The main port activities and services include the provision of infrastructure and machinery, docking, container handling and administration (González and Trujillo, 2009). The above considerations make the study of ports as a homogeneous entity more

difficult, and therefore this study focuses on container ports/terminals. Table 1 provides an overview of port-related studies classified according to the author(s) name, method used, data type, and geographical location.

Table 1
Studies reviewing the efficiency of container ports/terminals

Author(s) (year)	Method used	Data type	Geographical location
(Al-Eraqi et al., 2008)	DEA-CCR DEA-BCC	Panel data	22 Middle East and East Africa
(Liu et al., 2008)	DEA-BCC	Panel data	45 China
(Min and Park, 2008)	DEA-BCC	Panel data	11 Korea
(González and Trujillo, 2008)	SFA	Panel data	17 Spain
(Jiang and Li, 2009)	DEA	Cross-sectional	12 (China, Korea, and Japan)
(Wu and Liang, 2009)	DEA-BCC	Cross-sectional	77 international
(Ablanedo-Rosas and Ruiz-Torres, 2009)	DEA-BCC	Cross-sectional	29 Mexico
(Al-Eraqi et al., 2010)	DEA-CCR DEA-BCC	Panel data	22East Africa and Middle East
(Cullinane and Wang, 2010)	DEA-BCC	Panel data	25 international
(Simões and Marques, 2010)	DEA-CCR	Cross-sectional	41 Europe
(Hung et al., 2010)	DEA-BCC	Cross-sectional	31Asia-Pacific region
(Wu and Goh, 2010)	DEA-CCR DEA-BCC	Cross-sectional	20 largest container ports
(Wu et al., 2010)	DEA-CCR	Cross-sectional	77 international
(Kamble et al., 2010)	DEA-BCC	Cross-sectional	12 India
(Munisamy and Singh, 2011)	DEA-CCR DEA-BCC	Cross-sectional	69 major Asian Container ports
(Bichou, 2011)	DEA-CCR	Panel data	10 international
(Niavis and Tsekeris, 2012)	DEA-CCR DEA-BCC	Cross-sectional	30 Europe
(Demirel et al., 2012)	DEA-CCR DEA-BCC	Panel data	16 Mediterranean
(Bichou, 2012)	DEA-CCR DEA-BCC	Panel data	420 International
(Yuen et al., 2013)	DEA-CCR	Panel data	21 China and Asian
(Trujillo et al., 2013)	SFA	Panel data	37 African coast
(Schøyen and Odeck, 2013)	DEA-CCR DEA-BCC	Panel data	24 (Nordic + UK)
(Polyzos and Niavis, 2013)	DEA-CCR	Cross-sectional	30 Mediterranean
(Medda and Liu, 2013)	SFA	Cross-sectional	165 international
(Mokhtar and Shah, 2013)	DEA-CCR DEA-BCC	Panel data	Malaysia
(Munisamy and Jun, 2013)	DEA-CCR DEA-BCC	Panel data	30 Latin America
(Infante and Gutiérrez, 2013)	DEA-CCR DEA-BCC	Panel data	33 Asian Pacific region
(Sarriera et al., 2013)	SFA	Panel data	67 Latin America and Caribbean
(Ding et al., 2015)	DEA-CCR DEA-BCC	Panel data	21 China

Many authors provided a literature review for the measurement of ports efficiency. The most thorough reviews of studies focusing on the efficiency of ports are found in Odeck and Bråthen (2012), Woo et al. (2012), Pallis et al. (2011), Panayides et al. (2009), and González and Trujillo (2009).

Based on the previous studies, and with regard to Table 1, several general remarks can be made. First, the basic approaches to evaluating the efficiency of ports can be divided in two categories: those using parametric methods and non-parametric methods. The most popular non-parametric methodology is data envelopment analysis (DEA), and the most common parametric method is stochastic frontier analysis (SFA). Previous studies show that the DEA approach is commonly used to