Maritime Empty Container Repositioning: A Problem Review

Hossein Khakbaz, Institute of Transport and Logistics Studies, University of Sydney Business School, Sydney, Australia

Jyotirmoyee Bhattacharjya, Institute of Transport and Logistics Studies, University of Sydney Business School, Sydney, Australia

ABSTRACT

Maritime shipping containers are important to a number of different industries as they facilitate the reduction of transportation costs. To address the needs of shippers, empty containers need to be repositioned globally between seaports. Since the cost of empty container repositioning (ECR) constitutes a significant element of the total cost of running a global container fleet operation, the problem has been receiving increasing attention from scholars. The diversity of this literature necessitates the development an appropriate classification scheme to identify trends, gaps, and directions for future research. This paper reviews publications on maritime ECR over the last two decades and examines such trends and potential research directions.

Keywords: Empty Container Repositioning (ECR), Fleet Operation, Maritime, Shipping Containers, Transportation Costs

1. INTRODUCTION

A number of industries have benefited from the inexpensive movement of freight provided by maritime transport. Specifically, containerization has markedly improved the efficiency of cargo transport in the maritime industry. Container shipping, invented by Malcolm McLean in the 1950s, marked the start of modern maritime trade (Crainic, 1998; Fransoo & Lee, 2011). The amount of containerized cargo has grown at an average annual rate of about 7.5% from 1996 to 2012 (United Nations Conference on Trade and Development, 2012). It is estimated that the global container trade will grow by about 6.5% in 2013 to reach 169 million TEUs(Twenty-Foot Equivalent Units), which is equivalent to about 1.5 billion tons. However, at the same time, maritime transport faces several challenges. A significant ongoing problem is empty container repositioning (ECR). International trade is characteristically imbalanced, resulting in regions with a surplus and deficit of containers (Crainic & Delorme, 1993). Empty containers need to be repositioned globally between ports and regionally between consignees, inland depots, and terminals to meet the demand for empty containers. Drewry Shipping Consultants of London has estimated that 20% of all maritime container movements

DOI: 10.4018/ijsds.2014010101
are empty containers movements (Boile et al., 2006; Braekers, et al., 2011). The cost of ECR constitutes about 27% of the total cost of running a global fleet (Braekers, et al., 2011). Thus it is essential for shipping companies to have efficient and effective mechanisms for repositioning empty containers is a crucial issue. Other benefits of reducing ECR include a reduction in congestion and air pollution (Lopez, 2003; Bandeira et al., 2009; Boile et al., 2006; 2008).

The literature on maritime ECR is quite diverse because problem formulations and solutions for maritime ECR are generally concerned with specific applications. This makes it important to develop a classification scheme for the literature. Although several papers have addressed the literature on container management from different perspectives (Macharis & Bontekoning, 2004; Christiansen, et al., 2004; Wieberneit, 2008; Kitchenham, et al., 2009; Tran and Haasis, 2013; SteadieSeifi, et al., 2013), the classification scheme presented here was developed to address the lack of a comprehensive review that is concerned exclusively with maritime ECR. The only recent classification scheme for ECR was developed by Braekers, et al. (2011), but it mainly focuses on inland empty container repositioning and does not adequately address intercontinental and interregional repositioning. On the other hand, since the literature on maritime ECR in this paper is classified from the point of view of mathematical modelling, the classification scheme developed here is different from the one developed by Braekers, et al., (2011). This paper is organized as follows: Section 2 discusses the approach to the literature review. Section 3 provides a classification scheme for the ECR literature. Section 4 underlines trends in the literature and finally Section 5 highlights gaps in the research and identifies avenues for future research on the ECR problem.

2. METHODOLOGY

This semi-structured literature review was based on guidelines suggested by Kitchenham (2004), Kitchenham et al. (2009) and Talaei-Khoei (2013). The steps included (I) identification of resources, (II) selection of articles, (III) data collection and synthesis, and (IV) analysis.

2.1. Resource Identification

Keywords and abstracts from articles in six online databases were searched for the term “empty container” to identify relevant articles published between 1994 and 2013 in the fields of engineering, management, transport and logistics (See Table 1).

2.2. Selection of Articles

The objective of this step was to identify papers relevant to the topic of empty container logistics. Figure 1 presents the selection process. In the first iteration, in step 1.1, the six databases were searched for the phrase “empty container”. Then in steps 1.2, 1.3, and 1.4 titles, keywords, and full texts of articles were reviewed and those articles not relevant to the topic were excluded. Articles that were excluded:

1. Focused only on full container logistics,
2. Focused only on inland ECR,
3. Focused on other types of transportation rather than maritime transport,
4. Focused on the storage of empty containers,
5. Focused on the environmental aspects of empty container repositioning, focused on applications of empty containers (e.g., using empty containers as a residential unit or for other industrial purposes),
6. Focused on the manufacturing of empty containers,
7. Were not relevant to the field,
8. Were not written in English, or
9. Had not been subjected to peer review.

After the exclusion process, the 44 remaining articles were stored in an archive in Zotero Research Tool (http://www.zotero.org, 2012). In step 2.1 the references were searched for keywords and selected on the basis of detected matches. In steps 2.2, 2.3, and 2.4 the title, keywords, and full texts of these references were
The Decision Hedgehog: Group Communication and Decision Support
www.igi-global.com/chapter/decision-hedgehog-group-communication-decision/11250?camid=4v1a