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The academic literature on intermodal freight transport

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Abstract

It is widely accepted that non-road freight transport is less energy intensive than freight transport by road. The use of other transport modes than truck for long haul freight transport can therefore contribute to more energy efficient transportation systems. As a result, the successful promotion of intermodal transport, using rail or sea on the long haul part, has been identified as the most critical action to achieve a sustainable transport sector. The aim of this paper is twofold. First, we examine the historical development of academic research on intermodal freight transport. Second, we identify the seminal works on the topic. In our analysis we identify and classify the academic literature on intermodal freight transport. This approach has also previously been used to aggregate knowledge about particular fields of research and it aims to be as unbiased as possible by being auditable and repeatable. A timeline on the evolution of the academic literature on intermodal freight transport is presented and the development in publication frequency and topics are commented on in relation to keywords, journals, author affiliations and countries. Publishing frequencies are measured, and reported, both in terms of absolute and relative values. Finally, what is likely the most important and influential papers on intermodal freight transport are identified, using citation frequency.

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1. Introduction

Intermodal freight transport is the movement of goods in a single loading unit or vehicle that successively uses two or more modes of transport without handling the goods themselves in changing modes (UN/ECE, 2001). The main idea behind intermodal transport is to utilize the strengths of different transport modes in one integrated

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transport chain (Flodén, 2007), thereby improving the economic performance (Rodrigue et al., 2009). It has been argued that economic performance is improved because the most suitable transport mode is used on each part of a trip (OECD, 2001).

The main advantage of intermodal transport solutions is their comparatively low external costs (Hanssen and Mathisen, 2011). According to Forkenbrock (2001), the external cost of an intermodal train per tonne-km is only 28 % of the external cost of a general freight truck. However, the difference in external cost might be even greater than this as the cost of congestion was not included in the calculations (Hanssen and Mathisen, 2011).

Because intermodal freight transport is less energy intensive than freight transport by road (Woodburn et al., 2007), it is considered to be an important contribution to achieve a sustainable European transport sector (European Commission, 2009). Intermodal freight transport has therefore been promoted by policymakers on all levels (Macharis et al., 2011). However, the market share of intermodal freight transport has not developed as positively as expected (Janic, 2007). In order to continue the development of intermodal freight transport from the academic point of view, it is important to know the history and to identify the status of the current body of research. In this way it can be revealed where resources are lacking and also empirical cases of best practice can be identified and draw attention to success stories for other researchers to follow.

The aim of this article is twofold. First, we will review the literature on intermodal freight transport to identify (i) how the publication frequency of articles in the field has evolved, (ii) their focus and (iii) identify the journals, research institutions and countries which have been most active in the debate. This review will illustrate the involvement of research on intermodal freight transport. Second, we will identify the seminal works on intermodal freight and rank these based on how often they have been cited. It has been argued that the most cited articles in a field are the articles which have had the highest impact on that particular field (Ibrahim et al., 2012). Thus, this will be a list of classic articles that provide insight into what have been the most important topics for researchers addressing intermodal freight transport.

The remainder of this article is structured as follows. In Section 2, we describe the methodology used and the data sources applied. Then, in Section 3, the historical development of academic research intermodal freight transport is presented before the seminal works on intermodal freight transport are presented in Section 4. Finally, conclusions and implications are presented in Section 5.

2. Methodology

Transportation journals first emerged in the late 1960's with the *Journal of Transport Economics and Policy*, followed by the *International Journal of Transport Economics* (Button, 2006). However, the number of journals has developed significantly and by 2013 about 80 journals publishing articles related to transport and logistics were ranked by the Institute of Transport and Logistics Studies at the University of Sydney (2013).

The data presented in this article was gathered from Scopus, the world's largest abstract and citation database of peer-reviewed literature (www.scopus.com). The database was searched in order to obtain entries containing the term "intermodal transport" and at least one of the words "freight" or "goods". In order to be included these words had to appear either in the title, the abstract or in keywords defined either by the author or the database. The search was then restricted to journal articles written in English. The remaining number of entries was then 239 from the period from 1985-2013. Articles published in 2014 were omitted, since we are not able to obtain observations for the full year. An advantage of such a structured approach for the literature review is that it is easy to replicate which gives a high degree of reliability. This approach has been applied to study the body of literature within other topics, e.g. air transport (Ginieis et al., 2012).

Despite its extensive range of entries of journals within the transportation economics, the Scopus database does not give a complete picture of the body of literature. Hence, the selection of articles would be different if based on other sources. The data set was compared to a similar searching procedure by the ISI web of knowledge provided by Thomson Reuters (2014b). This database includes fewer journals and the number of observations was lower. However, the majority of articles found in the ISI search were present in the Scopus search, which indicates that the most important works are present in the data set applied in this paper. The use of a more extensive search engine, such as Google Scholar, would include many observations that are not peer reviewed and perhaps of lower scientific

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