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### Abstract

In this study the efficiency of Finnish ports and their impact on the Baltic dry bulk shipping is being investigated. The objective of the research is to examine the efficiency of Finnish ports in dry bulk shipping. In addition their suitability for a new multifunctional and self-discharging vessel concept is determined.

The theoretical part of the study is divided into two sections. In the first one, the literature regarding functions of the port system and its management is introduced, along with different operational port system models. Literature on port efficiency is reviewed in the second section, where the different methods for measuring it are presented. Methods from single factor productivity to optimum throughput and from frontier models to benchmarking are addressed, but costs are not ignored either. The relation between efficiency and productivity is explained as well.

In the empirical part of the study a general view over the 25 million ton dry bulk shipping market of Finland is first provided. In total 14 Finnish ports with substantial importance in Baltic dry bulk shipping are analyzed as individuals, as well as members of their respective port classes. Port classes are determined according to the ownership and cargo division of the port. Public ports are separated from private ones, as well as bulk oriented ports ,are from non-bulk oriented. This classification is compared with the one of Jalkanen (1996) presented in his doctoral dissertation.

The different time elements of the port call and their relations are presented port by port, as well as the port call's cost structure. The cargo throughput, cargo size and port call duration distributions are presented and analyzed by ports as well as by port classes. Data envelopment analysis is conducted from the ship owner's point of view by comparing costs and throughputs of the port calls. They do not seem to correlate. The benchmarking of the self-discharging vessels showed that they perform rather well in ports of the study. Throughputs have strong influence on cost efficiency.

Dry bulk shipping scenarios are simulated with a simulation tool TurboRouter. The reasonable fleet size in current situation is two older cement vessels and two to three multifunctional new vessels, which make small profit or are close to break-even point. In anticipated future scenarios both make substantial profit. In current and future scenarios especially the undelivered shipments cause massive problems. Logistics efficiency does not seem to explain cost efficiency at all.

Key words	Dry bulk shipping, port efficiency, throughput, simulation and profitability
Further information	

