

The Sustainability and Competitiveness of European Short-Sea Shipping

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- Paper 2: Raza, Z., Woxenius, J., Finnsgård, C., 2019. Slow steaming as part of SECA compliance strategies among RoRo and RoPax shipping companies. *Sustainability*, 11(5), 1–19.
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- Paper 3: Christodoulou, A., Raza, Z., Woxenius, J., 2019. The integration of RoRo shipping in sustainable intermodal transport chains: The case of a North European RoRo service. *Sustainability*, 11(8), 1–17.
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- Paper 4: Raza, Z., 2019. The effect of Regulation-Driven Green Innovations on Environmental and Economic performance of Short Sea Shipping in Europe Resubmitted for consideration for publication in the special issue on “Improving the Environmental Performance of Shipping and Ports” of *Transportation Research Part D: Transport and Environment*



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Several factors could improve the environmental performance of European short-sea shipping (SSS) and enhance its competitiveness, and in this thesis, some of those factors are explored. The purpose of this thesis is to both explore factors with the potential to improve the environmental sustainability of European SSS and analyse the industry's competitiveness. Its findings are drawn from four studies that involved accessing multiple sources of data that includes a systematic literature review, interviews and a survey of SSS companies operating in Europe. As a whole, the thesis provides an overview on the various types of factors, especially slow steaming, collaboration and green innovations that can impact the environmental sustainability and competitiveness of SSS in Europe.

The findings indicate that for the roll on, roll off (RoRo) and roll on, roll off cargo and passenger transport (RoPax) sectors of SSS, bunker prices, rigorous competition and, above all, different service quality requirements in terms of total transit time, frequency, reliability and the convenience of departure and arrival times significantly restrict slow steaming's potential implementation. Beyond that, a 0.1% sulphur regulation enacted in 2015 has not triggered slow steaming in the RoRo and RoPax sectors to a great degree. One reason is that during the implementation of measures to meet the 0.1% regulation, a drop in bunker prices caused by lower crude oil prices made slow steaming economically unattractive in those sectors. Another reason is that the increased costs of using marine gas oil are partially transferred to customers and partly borne by the shipowners.

The findings additionally suggest that collaboration between shippers and SSS operators significantly improves the environmental and economic performance of SSS. SSS operators and large shippers in Europe should thus seek opportunities for strategic collaboration and shared planning with other agents in their transport chains. Strategic collaboration among cargo owners, ship operators and forwarding agents can especially enhance the efficiency of systems, shorten lead times, reduce emissions, lower costs per unit of output and, in turn, generate mutual benefits for all stakeholders involved.

Last, the findings also reveal that green innovations, including ones related to energy-efficiency, have a substantial impact on the economic and environmental performance of European SSS firms. Accordingly, managers at SSS firms can enhance the environmental and economic performance of their companies by dedicating resources to developing green and energy-efficient technological solutions. At the same time, they should not wait for regulations to begin developing green innovations but take a proactive approach to pursuing such innovations, which can benefit the performance of their companies.

Keywords: Short-sea shipping, environmental sustainability, competitiveness, improvement factors, slow steaming, collaboration, innovation