

Digitalized Cargo Coordination to Eliminate Emissions in the Shipping Ecosystem: A System Dynamical Approach

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Abstract : The shipping sector generates significant amounts of carbon emissions on annual basis. The excess amount of carbon dioxide is harmful for both the environment and the society, and partly for that reason, there is acute interest to decrease the volume of anthropogenic carbon dioxide emissions in shipping. The usage of the existing cargo carrying capacity can be maximized, and the share of time used in actual transportation operations could be increased if the whole transportation and logistics chain was optimized with the aid of information sharing done through a centralized marketplace and an information-sharing platform. The outcome of this change would be decreased carbon dioxide emission volumes produced per each metric ton of cargo transported by a vessel. Cargo coordination is a platform under development that matches the need for waterborne transportation services with the ships that operate at a given moment in time. In this research, the transition towards adopting cargo coordination is modelled with system dynamics. The model encompasses the complex supply-demand relationships of ship operators and cargo owners. The built scenarios predict the pace at which different stakeholders start using the digitalized platform and by doing so reduce the amount of annual CO₂ emissions generated. To improve the reliability of the results, various sensitivity analyses considering the pace of transition as well as the overall impact on the environment (carbon dioxide emissions per amount of cargo transported) are conducted. The results of the study can be used to support investors and politicians in decision making towards more environmentally sustainable solutions. In addition, the model provides concepts and ideas for a wider discussion considering the paths towards carbon neutral transportation.

Keywords : carbon dioxide emissions, energy efficiency, sustainable transportation, system dynamics

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