

# **System Dynamics of Sustainable Port Management**

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This paper presents progress on development of a system dynamic framework of management and policy related intermodal transport of containerized cargo at port facilities. Ports are recognized to be inherently complex systems acted on by many ecological, technological, economic, and community factors. Sound management practices and policies for port facilities need accommodate and balance these factors against an appropriately broad set of sustainability indicators, if long-term viability of such locations and facilities is to result. The aim of the research and this paper is to (1) outline an approach that combines analytically flexible system dynamic methods with the holistic perspective of ecological economics, and (2) support articulation of sound port management policy decisions that ensure continued focus on sustainable objectives. The ensuing model attempts to capture important hi-level influences that collectively describe a dynamic system possessing co-evolving socio-economic and ecological features. Model content is loosely associated with the notion of sustainability and more particularly sustainability of marine surface water transport of containerized goods. The co-evolving features are attributed with continuous and discrete-time processes and spatially distributed properties of fixed and mobile assets. The basic dynamic structure of the model is presented as having seven variables embedded in a context of (1) causal influences related to socio-economic and ecological factors, (2) related feed-back processes, and (3) implicit spatial-temporal processes. Foundational influence diagrams are presented for pollution effects/measures, dredging activity impacts, and the operational dynamics of the waterside-landside interface of intermodal transport within a port infrastructure. These foundational influences are discussed as they affect three master variables - trade flows, eco-indicators, and natural assets. Conclusions about work to date and direction of on-going research are presented.