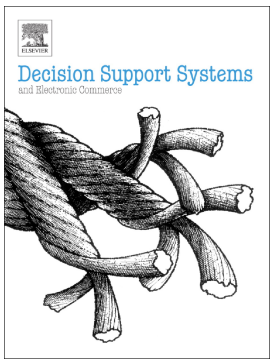

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PII: S0167-9236(18)30033-2
DOI: https://doi.org/10.1016/j.dss.2018.02.004
Reference: DECSUP 12930

To appear in: *Decision Support Systems*

Received date: 22 May 2017
Revised date: 24 November 2017
Accepted date: 9 February 2018

Please cite this article as: Pasquale Legato, Rina Mary Mazza , A decision support system for integrated container handling in a transshipment hub. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Decsup(2017), https://doi.org/10.1016/j.dss.2018.02.004

A decision support system for integrated container handling in a transshipment hub

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Abstract

The productivity of a maritime container terminal can be improved through a model-driven decision support system (DSS) focused on a better integration among container handling operations occurring across the quay, transfer and yard areas. Integration is pursued to minimize the blocking, locking and other queuing phenomena which are unavoidable, especially when human-operated equipment is shared in a real environment subjected to several random events and activities. An integrated queuing network is proposed in this paper as the natural modeling paradigm for a DSS aimed to highlight and quantify the blocking, locking and other queuing phenomena experienced in real practice. After an in-depth discussion of the limitations of solving the queuing network model analytically, discrete-event simulation is adopted as solution method. Numerical examples referred to a case study for a real transshipment hub return reliable estimates for the above queuing phenomena. They illustrate how the queuing-based DSS may effectively support the operations manager in determining the proper operational policies and equipment management with respect to a proficient integration of container handling operations.

Keywords: Model-driven decision support systems, port operations, integration, blocking and locking, queuing model, simulation

1. Introduction

In 2013 the 10 largest container ports in the world accounted for 39.7% (i.e. 204m TEUs) of the total volumes handled by the world's 100 leading container ports [10]. These mega-ports are responding to the ongoing vessel upsizing pursued by the container industry which is also embracing new alliance