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Port Operations and Container Terminal Management

with applications

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ABSTRACT

PORT OPERATIONS & CONTAINER TERMINAL MANAGEMENT

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Seaports are crucial nodes in global maritime supply chain and thus efficient management of the terminals is a thing of utmost importance for the global economics. This book explains the port operations and proposes approaches that aim to improve the most important successive steps in container terminal management activities.

Initially, a multi-period assignment problem that seeks to allocate vessels to berthing spaces and quay cranes is studied. A mathematical model that handles berth and crane allocations simultaneously for multiple terminals is developed. The method is able to model continuous quay allocation with fixed and mobile cranes. Furthermore, the vessel handling times are dynamic and dependent on the unfixed crane assignments that may be altered throughout the service time of the ship. The suggested optimization model minimizes the handling times of the vessels. Practical achievements are assessed by an implementation of the model to the Port of Izmir. Current facts reveal that the upgrading of the existing container terminal is of great importance and urgency in terms of meeting the ever-increasing demands of the national as well as international economies.

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Comparisons with the actual records show that noteworthy reductions in current vessel waiting times can be achieved by the proposed model.

Subsequently, a discrete-event simulation model for the real life detailed processes performed during the handling of import containers is developed. In particular, the model focuses on the storage assignment problem at the operational level in a container terminal with a multiple-berth structure. An approach by means of a hierarchical structure is adapted to partition the assignment problem into two sub-problems and solve each of them using separate decision rules. Suggested storage policies are evaluated in view of the overall performance of the container terminal. Different traffic densities are experimented to reflect the real-time environment. Simulation runs emphasis the bottleneck at the quay cranes. Results confirm that the quay crane efficiency may be improved by using appropriate storage policies. Strategies that adopted the integrated assignment method at the first level, where travel distances and gantry crane workloads are considered, performed best when coping with this crisis. At the second level of the hierarchy, with the use of segragated strategy, in which estimated container departure dates are considered, number of reshuffles is reduced. Implementation of the model to the existing terminal shows that noteworthy improvements in the current port performance indicators can be achieved.

The implementation of the project will lead to the efficient port management, better operational and financial performance for the Izmir Port and externalities such as increase in employment, development of qualified labor force and expansion of trade volume in the Aegean Region. The problems faced by the focused port are common for most of the terminals around the world. Hence, the findings can also be beneficial for ports in the other parts of the world.

Keywords: port management; port logistics; modeling; simulation; transportation; container handling; optimization

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