OPTIMIZATION APPLICATIONS IN SEAPORT CONTAINER TERMINAL OPERATIONS AND FUZZY LOGIC-BASED INTER TERMINAL TRUCKING

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218049H

Degree of Master of Science

Department of Transport and Logistics Management
University of Moratuwa
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DECLARATION OF ORIGINALITY

I declare that this is my own work, and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or institute of higher learning and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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(Buddhi A. Weerasinghe)

STATEMENT OF THE SUPERVISOR

The above candidate has carried out research for the Degree of Master of Science under my supervision.

Name of the supervisor: Dr. H.N. Perera

Signature of the Supervisor: UOM Verified Signature Date: 30th September 2022

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University of Moratuwa.

ABSTRACT

Operations research techniques have helped optimize container terminal operations over the past decades and have been a regular feature of maritime logistics and maritime supply chain literature in addition to being in practice at container terminals across the globe. The first phase of the project, a systematic review systematically collates through Scopus and analyzes 1631 papers published in the domain to find the main research clusters and understand future research directions. Studies based on both quayside and landside planning are encapsulated for this research. Five research clusters that discuss simulation, scheduling and automation, quayside operations, integrated operations, and container transportation are identified based on author keywords of the systematically derived paper pool. In addition to that, the evolution of applying optimization techniques in container terminal operations planning is discussed in this study alongside the suggested trajectory of the research agenda under each cluster. The analysis finds that genetic algorithms, integer linear programming and heuristics are the most widely used operations research techniques in container terminal optimization. The review proposes the application of methods such as neural network, fuzzy logic and deep learning models related to artificial intelligence to widen our understanding of container terminal operations. The second phase of the project is conducted to optimize ITT truck flows in container terminals by following the research direction that is derived through the cluster, container transportation in the systematic review. The proposed model is developed using fuzzy logic in MATLAB software. The model can allocate ITT trucks based on the demand from terminal yards and current truck arrival rates at gatehouses. More industry and academia as well as inter-terminal collaborations are needed in future studies for enhancing ITT operations and the overall operations in container terminals.

Keywords: container terminals, systematic review, inter-terminal transportation, optimization, maritime logistics, fuzzy logic

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LIST OF ABBREVIATIONS

ITT	Inter Terminal Transportation
YC	Yard Crane
MCC	Multi-Country Consolidation
LCL	Less than Container Load
QC	Quay Crane
QGC	Quay Gantry Crane
RMG	Rail Mounted Gantry crane
RTG	Rubber Tired Gantry crane
SC	Straddle Carrier
SFD	Stack and Flow Diagram
YT	Yard Truck
SLPA	Sri Lanka Ports Authority
SAGT	South Asia Gateway Terminals
CICT	Colombo International Container Terminals
JCT	Jaya Container Terminal

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