

A Study in Modern Container Terminal Efficiency

by

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Abstract:

Maritime transport is the backbone of international trade affecting global economy critically. Majority of cargoes are transported via ocean-going container vessels served by terminal operators. While vessel size increases significantly and liner services are demanded with substantial and continuous improvement in efficiency in the past few decades, the operating conditions of many modern container terminals remain the same. Without critical infrastructural change, capital investment or novel efficiency improvement strategy, both terminal efficiency and business subjects to limitation for improvement. This critically affects the competitiveness of terminal and port in both regional and global competitions.

This thesis focuses on terminal efficiency in the modern container shipping industry, addressing three principal research questions: 1) How is a modern container terminal's efficiency, as commonly represented by the annual throughput volume, determined in principle during the different planning and operations stages in a terminal? 2) What are the hidden influences on terminal efficiency performance and how can they be accounted for in possible berth allocation solutions when vessel schedules fluctuate severely? 3) What is the effect on terminal efficiency and the best berth allocation arrangement when additional vessels are added to the original vessel set?

Four key determinants on modern terminal efficiency are identified from our comprehensive literature reviews, following by the best way to achieve efficiency improvement that is applicable to most of the terminals worldwide, regardless to the level of modernization. Hidden problems that affect efficiency on prolonged basis are reviewed with two global efficiency influences identified. The two hidden influences are: (a) vessel workload waiting time and (b) additional vessel demand on ad hoc basis. They affect efficiency critically, and are modelled for improvement with optimal conditions introduced for each influence. Solution is investment-free that no additional or critical change in the terminal's infrastructure and capital, and it could be implementable immediately without any cost or change required in the terminal's organization structure or information system.

For the first influence, solution is provided to minimize the adverse effect due to prolonged vessel workload waiting time. Exceptional long vessel berthing periods are significantly reduced that improves terminal operational efficiency effectively with higher berth utilization. Throughput volume per berth-time unit is also increased. For the second influence, solution is provided to minimize the adverse effect due ad hoc vessel demand handling. This enables operations with the lowest operational cost per handling unit whenever ad hoc vessel demand exists. This again improves terminal efficiency with higher berth utilization and further achieves additional throughput volume.

This thesis aimed to increase a terminal's business profit with optimal vessel berthing arrangement that benefit both liners and terminal in terms of higher cargo acceptance successful rate, operational flexibility as well as more reliable operation patterns in the terminal. In practical terms, this study contributes to the maritime industry with a novel strategy on terminal efficiency improvement that the proposed models could be applied to other types of ocean terminals serving non-container merchant vessels for improvement in both terminal efficiency and port competitiveness.

Bio:

Tong Hang-fa is a Ph.D candidate in the Department of Logistics and Maritime Studies, the Hong Kong Polytechnic University. She received her BEng (Hons) in IEEM from HKUST, specializing in Process Re-engineering and Information Management, and MPhil in IELM, HKUST, focusing on Third-Party Logistics and Transportation Network. She has a long working experience in maritime industry, including shipping line (OOCL) and container terminal (Cosco-HIT) respectively for several years. She has also worked as a member of the grand opening team for Hong Kong Disneyland (HKDL), responsible for the overall back-of-house (BOH) transportation logistics planning and implementation. She is aspiring to be a good teacher and researcher on port & terminal operations and management, maritime logistics and optimization area, by combining her long practical experience with the modern development in maritime studies and insights. She is currently pursuing her Ph.D under the supervision of Prof. Hong YAN.

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All are welcome!