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Editorial

State-of-the-Art in Ports and Terminal Management and Engineering

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1. Introduction

Ports and terminal management, coupled with engineering practices, play a critical role in facilitating global trade and optimizing logistics operations. As the maritime industry continues to evolve, staying abreast of the latest developments and innovations in these areas is essential. This editorial aims to provide a comprehensive overview of the state-of-the-art in ports and terminal management and engineering, incorporating key research papers that delve into dynamic appointment rescheduling of trucks under uncertainty of arrival time [1], historic automation projects of brownfield container terminals [2], rent fee assessment on the port railway station through a litigation case study of a Korean container terminal [3], and a hybrid dynamic method for conflict-free integrated schedule optimization in U-shaped automated container terminals [4]. Additionally, we will explore the factors influencing container seaport competitiveness, using the Port of Rijeka as a case study [5].

2. Paper Details

Xu et al. [1] conducted a comprehensive study on dynamic appointment rescheduling of trucks under uncertainty of arrival time. They proposed innovative techniques to address the challenges posed by uncertain arrival times, focusing on real-time rescheduling and optimization of truck appointments. Their research presents a dynamic appointment rescheduling model that considers uncertain arrival times of external trucks. The model incorporates an external truck reconfirmation strategy, where drivers confirm timely arrival 30 min before appointments. If trucks cannot arrive on time, the TAS initiates rescheduling to minimize costs.

The simulation experiments demonstrated the effectiveness of the truck dynamic appointment rescheduling model in reducing comprehensive operating costs for both the truck and port companies while alleviating port congestion. The cost of rescheduling was significantly influenced by factors such as the probability of trucks failing to arrive on time, the lead time for truck arrival confirmation, and the duration of delays. The findings of this study provide valuable insights for operational decision making by managers in the field of truck management in ports and terminals.

Furthermore, this research introduced an adaptive quantum revolving door update mechanism and proposed a double-chain real quantum genetic algorithm, which outperformed traditional genetic and tabu search algorithms. The study offers a significant reference for future research in the area of truck management in ports and terminals.

Burgos Gajardo et al. [2] conducted a comprehensive research analysis on historic automation projects in brownfield container terminals. Their study examined successful initiatives, case studies, implementation strategies, and lessons learned. The authors provided valuable insights into the challenges encountered during the transition to automation, the benefits achieved, and the transformative impact on terminal operations. This analysis serves as a valuable resource, offering guidance and insights to industry professionals planning to implement automation in existing terminals.

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The researchers employed an empirical research methodology adapted from "Empirical Research Methods in Operations Management" by Flynn et al. They initially identified a population of historically converted terminals through desk research, resulting in a list of twenty-nine terminals. A questionnaire was then developed and distributed to gather practical experiences related to drivers, challenges, solutions, benefits, drawbacks, and level of automation implemented in these terminals. Detailed questions were included to address major challenges identified through preliminary interviews with industry experts. This approach provided a comprehensive understanding of historic automation projects in brownfield container terminals, offering valuable insights for practitioners and decision-makers in the field.

The findings highlighted that the main drivers of automation are OPEX reduction, increased productivity, and addressing labor shortages. However, it is essential to establish clear automation goals before devising appropriate solutions. Challenges associated with automation include ensuring uninterrupted operations, adapting to new processes, and maintaining positive labor relations. Strategies such as phased implementation and effective training contribute to continuity during the automation process. Drawbacks encompass technical problems, lower productivity, and skill set requirements. Mitigating these drawbacks involves prioritizing resiliency, redundancy, and evaluating terminal performance during planning. Semi-automated solutions are commonly preferred due to their ability to address labor issues and enhance productivity. Further research is needed to gain deeper insights into the challenges faced by brownfield automated terminals and provide valuable guidance for planning and implementation.

Park and An [3] conducted a study that focused on assessing rent fees for a port railway station through a litigation case study of a Korean container terminal. The authors examined the legal and financial aspects of rent fee assessment, providing valuable insights into determining fair rent fees and their implications for port operations. Their research study serves as a valuable resource for policymakers, port authorities, and industry professionals involved in similar assessments, offering guidance on evaluating rent fees for port railway stations. In this study, the researchers collected data on investment costs, operating costs, and sales required for the construction of the rail station. Based on these data, they proposed an appropriate rent fee by analyzing the cash flow over a 30-year operation period. The study assumes that the port railway station operator efficiently operates the facility to calculate the suitable rent fee.

The revenue of the port railway station was calculated by considering its cargo capacity, the port capacity of nearby terminals, and the expected throughput ratio. The loading and unloading costs were determined by referring to the existing port railway station's costs. From the perspective of the lessor or investor, the proper rent fee was calculated as the total investment cost that can be recovered during the rental period. From the operator's perspective, the proper rent fee was calculated to ensure a reasonable rate of return. The discounted cash flow (DCF) method, commonly used for evaluating firm value, was employed to calculate the proper rent fee for the railway station. This method considers the present value of net cash flows and the present value of rent fees during the rental period. All the data used in this study were directly provided by the port authority and the port railway station operator, ensuring reliability and fairness.

Xu et al. [4] proposed a hybrid dynamic method to optimize the schedule in U-shaped automated container terminals, aiming to minimize conflicts and improve operational efficiency. By integrating advanced algorithms, optimization techniques, and real-time data, the authors demonstrated how these measures can lead to enhanced throughput, reduced waiting times, and improved overall performance. The research findings contribute to the development of strategies for terminal operators and decision makers seeking to optimize automated container terminal operations.

In U-shaped automated container terminals, the travel distance for Automated Guided Vehicles (AGVs) during loading and unloading in the yard is longer. This results in mutual waiting between the AGVs and double-cantilever rail cranes, which negatively

impacts overall handling efficiency. To address these challenges and enhance loading and unloading efficiency in U-shaped automated container terminals, this paper focused on the unloading process. The researchers established a hybrid dynamic model for multi-equipment integrated scheduling based on bi-level programming. This model comprises a discrete event dynamic model and a continuous time dynamic model.

Tijan et al. [5] conducted a comprehensive case study on the factors that influence the competitiveness of container seaports, with a specific focus on the Port of Rijeka. Their research delved into various aspects, including infrastructure development, connectivity, regulatory frameworks, port governance, and sustainability initiatives. By analyzing these factors, the authors provided valuable insights into enhancing the competitive position of container seaports. The case study on the Port of Rijeka serves as a practical reference for port managers and policymakers aiming to improve the competitiveness of container seaports.

While previous studies on the Port of Rijeka exist, they lack detailed elaboration on seaport competitiveness factors, indicating a research gap. To bridge this gap, the authors initially identified the competitiveness factors influencing container seaports through a thorough literature review. Subsequently, they conducted a case study on the Port of Rijeka, considering the identified factors, such as the port's geographical location, feeder connection, maritime connectivity, infrastructure and superstructure of the container terminal, berth length, port depth, port area characteristics, road and railway infrastructure, port reputation, costs, customs procedure efficiency, and ICT systems.

Finally, based on their analysis, the authors proposed measures to improve the competitiveness of the Port of Rijeka. This presented case study can serve as a valuable reference point for similar container seaports that face resource limitations but seek to enhance their efficiency and competitiveness.

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