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## A Simulation-Based Optimization Framework for Prime Mover Assignment in Container Terminals

### Communication Info

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### Abstract

Terminal performance in container ports is often constrained by poor resource allocation such as uneven deployment of prime mover (PM) and weak synchronization between quay cranes (QCs) and transport vehicles (Carteni & Luca, 2012; Carvalho et al., 2025). This study proposes a simulation-based optimization framework to evaluate and improve PM assignment strategies by modelling the dynamic and stochastic interactions among QCs, PMs, and yard operations (Cahyono et al., 2021; Dragović et al., 2017; Steenken et al., 2004). Simulation results show that pooled fleet (PF) improves vessel service time, PM utilization, and QC productivity through flexible allocation and dynamic reallocation of PMs. Exclusive haul (EH) provides more stable PM movements but is less efficient when workload distribution is uneven which leads to increased idle times and longer vessel handling durations. However, EH demonstrates lower fuel consumption under certain conditions as PMs can leave the system immediately after completing tasks.

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