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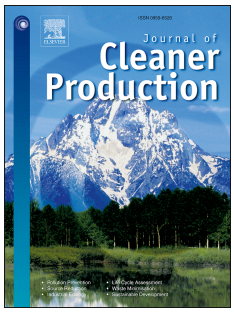

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Simulation based Multiple Disturbances Evaluation in the Precast Supply Chain for Improved Disturbance Prevention

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Abstract

Disturbances are inevitable and ubiquitous in the precast supply chain. Systematic evaluations of the impact of individual disturbances to prioritize the prevention of various disturbances are critical for realizing the full potential of logistical profits. This is especially true when the disturbance prevention budget is insufficient. Whereas, existing studies focused primarily on single disturbance analyses or precautions evaluation. This study proposes an overall disturbance evaluation model to assess the uncertainty of precast supply chain. The model is developed using ARENA-based discrete event simulation methods, and aims to address the lack of systematic multiple disturbances evaluation before the implementation of precaution measures. The model constructs include a real-world precast supply chain environment which considers four categories of disturbances derived from suppliers, manufacturers, logistics, and customers. In the model, the importance of disturbance is evaluated from both operational and economic perspectives, and the upper bound for the implementation cost of each precaution measure is provided. Finally, eleven scenarios with different levels of exposure to disturbances are investigated to test the validity of the proposed approach. Numerical results indicate that system failure is the most critical disturbance in this precast supply chain, followed by PC quality problem, PC reproduction owing to repair failure, and the material quality problem. The findings could facilitate the multiple disturbance management in the precast supply chain.

Keywords: Precast components; precast supply chain management; disturbance prevention; priority evaluation; discrete event simulation

1. Introduction

Prefabrication is a form of industrialization that transfers construction activities from the field to off-site plants. Because of the potential benefits in construction quality, efficiency, and environmental impact, prefabrication technologies have been extensively applied in public housing and transportation infrastructure projects. The China State Council, for example, announced that the proportion of precast construction in any individual construction project should be increased to 30% in ten years, and all new