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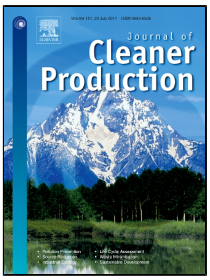

Production-Inventory-Routing Coordination with Capacity and Time Window Constraints for Perishable Products: Heuristic and Meta-heuristic Algorithms

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Production-Inventory-Routing Coordination with Capacity and Time Window Constraints for Perishable Products: Heuristic and Meta-heuristic Algorithms

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Abstract

Many industries are involved in production and distribution of perishable products. On one hand, due to the short life cycle of these products, there should be more precaution on the issues related to supply chain planning including material requirement planning, production, transportation, etc. compared to the ones in other industries. On the other hand, as there is a fierce competition among various companies, the need for coordination in such activities is imperative, where the use of an integrated approach is justifiable. One of these coordination problems is how to integrate important operational decisions including production scheduling and vehicle routing problem; the most important issues to fulfill customers' satisfaction. In this paper, a mathematical programming approach is taken to consider these two issues together in order to maximize the profits obtained by selling the products. At the production level, a multi-stage, multi-site, multi-period production system with production capacity constraints is considered, in which the inventory at each stage of production is taken into account to calculate the corresponding holding costs as well as to schedule a more appropriate plan. At the delivery level, the vehicle routing problem is tackled regarding different transporting vehicles with different capacities in a multi-period condition. In addition, time windows constraints are included at this planning level for the perishable products. Two heuristic and meta-heuristic algorithms are proposed to solve the proposed problem. Several numerical examples are solved at the end to evaluate the performances of the two solution methods and to show the effectiveness and efficiency of the proposed algorithms. The obtained results indicate that the proposed meta-heuristic algorithm is better than the heuristic algorithm in terms of the objective function value.

Keywords: Production scheduling; Inventory; Vehicle routing; Time window, Heuristic; Meta-heuristic

1. Introduction

In today's competitive environment, companies are looking to achieve greater profits and to meet further customer satisfaction. One of the most important issues in this regard is coordination between various elements of supply chain (Vahdani et al., 2011; Marchetti et al., 2014). In addition to the quality of products, which is one of the most important factors in customer's satisfaction, on time delivery of products to customers has also an undeniable role

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