An integrated production scheduling and delivery route planning with multi-purpose machines: A case study from a furniture manufacturing company

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Objective

Integrated production-distribution scheduling (IPDS) as a necessity in effective management of production and logistics decisions, plays a vital role in increasing customer satisfaction at minimum total cost. Such coordination is necessary in make-to-order (MTO) supply chains where a timely delivery at lowest operational cost as well as a high customization is a challenging issue. To meet this challenge, in addition to a closer linkage between production and distribution schedules, an appropriate production system is required. This paper proposes a mixed integer model to investigate a bi-objective production scheduling-vehicle routing problem with time window, arising from an MTO business, where it is assumed that production is done in a flexible job-shop environment.

Materials and methods

Based on experimental data derived from a real production system in MTO environment, the proposed model is first solved optimally by the ε −constraint method, and then a hybrid meta-heuristic algorithm combining of the particle swarm optimization (PSO) and ε −constraint method is developed to solve the model in medium-and large-sized problems in a reasonable time.

Result

The capability of the proposed model is illustrated by solving a numerical example in small sized for three different values of ε, and obtained results are professionally analyzed. The conflict between our two given objectives (total cost of production and distribution, and penalty cost of delivery earliness or tardiness) is demonstrated, and depicted. The applicability of the model is managerially highlighted through solving some test problems comparing the results of the proposed integrated model and that for the separate approach. Performance of the proposed meta-heuristic is evaluated through solving several test problems and comparing the Pareto solutions obtained from the proposed meta-heuristic algorithm with those obtained by the ε-constraint method.

Conclusion

The results show that the model has a superior ability to make a trade-off between cost and customer satisfaction. More specially, we note that the penalty cost of earliness or tardiness is reduced around 47%, while total cost are fixed.

Keywords: Supply chain scheduling, multi-objective optimization, integrated production-distribution, ε –constraint method, hybrid particle swarm optimization algorithm.