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A framework for financial supply chain optimization

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Abstract

In this paper, we discuss optimization of cash flow in the context of supply chain planning. The supply chain can be efficiently modelized as a job shop, with positive and negative cash flow constraints. A framework is introduced, based on a disjunctive graph to model both the job-shop problem and cash flow constraints and on a memetic algorithm for job sequences generation on machine. Tackling financial consideration using the job-shop to model supply chain permits to consider the proper coordination of production units and financial constraints when optimizing the supply chain operational planning. Job sequence generations on machines are addressed using Bierwith' sequences to obtain only acyclic graphs. Experiments on instances with positive and negative cash flow show the method addresses the problem efficiently and permit to highlight the impact of cash flow on solutions with regards to the job-shop solutions.

Key words: Finance, Metaheuristics, Scheduling, Supply Chain Management.

1 Introduction

In a wide range of problems, supply chain optimization is addressed in this strategic way considering only [1] manufacturers and retailers [2]. Production planning tools (commonly integrated in ERP), address strategic supply chain optimization including: i) storage capacities, rules and constraints per product group required to produce ; ii) evaluating the best volume to be taken in warehouses or by manufacturers, as well as advising on minimum/maximum stocking levels at warehouses' and retailers' points. From a scheduling point of view the objective is delivering jobs according to due dates and warehouses' capacity. From a financial point of view, the aims depend on strategic or tactic considerations including the net present value or the cash flow. Gunasekaran and Ngai [3] have proposed a review on metrics for evaluating chain performance and distinguishing between financial and non-financial metrics**.** Modeling a supply chain as a job-shop allows to take into account phenomena such as reverse logistics. The fact that integrating financial flows allows to extend financial constraints on physical flows. One of the challenging problems in supply chain management consists in coordinating production units and financial considerations properly. The main origins of costs in supply chains are capacity and material costs which must be carefully coordinated. Typically scheduling decisions are made in the short term (several weeks or months) and financial decisions follow to satisfy the required base-stock levels and human resources. Operational planning in scheduling [4] has the same horizon term as cash management planning. The Job-Shop Problem consists in scheduling a set of l jobs which have to be sequenced on m

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