Genetic Algorithm Optimization of a Two-Echelon Supply Chain Network [*]

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Abstract

A production-distribution plan integrates the decisions in production, transport and warehousing as well as inventory management. The overall performance of a supply-chain (SC) is influenced significantly by the decisions taken in its production-distribution plan. Hence, one key issue in the performance evaluation of a Supply Network (SN) is the modeling and optimization of production-distribution plan considering its actual complexity. Based on the integration of Aggregate Production Plan and Distribution Plan, this paper develops a mixed integer formulation for a two-echelon supply network considering the real-world variables and constraints. A Genetic Algorithm is then proposed for the optimization of the developed mathematical model and the methodology will be applied to a real-world case study incorporating multiple time periods, multiple products, multiple manufacturing plants, multiple warehouses and multiple end-users.

Key words: Supply Chain Management, Supply Network, Optimization, Mixed Integer Formulation, Genetic Algorithms

1   Introduction

Supply chain (SC) is the network of organizations, people, activities, information and resources involved in the physical flow of products from suppliers to the customers. Supply Chain Management (SCM) is, therefore, the process of integrating and utilizing suppliers, manufacturers, warehouses, and retailers; so that products are produced and delivered to the end users at the right quantities and at the right time, while minimizing costs and satisfying customer requirements. Implementation of a SC has crucial impacts on organizations' financial performance. Manufacturing and distribution companies require generic and customized software packages for the effective management of their logistics and SC activities through the selection of strategies, asset configurations, participants and operating policies. The increasing interest in evaluating the performance of supply networks over the last years indicates the need for the development of complex optimization models able to answer unsolved questions in the production-distribution network. This paper aims to develop a mixed integer formulation for a two-echelon supply network that extends the previous models through the integration of Aggregate Production Plan and Distribution Plan. As illustrated in figure 1 bellow, the first echelon would consist of multiple production plants and the distribution of items from plants to distribution centers

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