Chapter 10

Genetic Algorithm and Particle Swarm Optimization for Solving Balanced Allocation Problem of Third Party Logistics Providers

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ABSTRACT

Third party logistics (3PL) service providers play a growing responsibility in the management of supply chain. The global and competitive business environment of 3PLs has recognized the significance of a speedy and proficient service towards the customers in the past few decades. Particularly in warehousing, distribution, and transportation services, a number of customers anticipate 3PLs to improve lead times, fill rates, inventory levels, etc. Therefore, the 3PLs are under demands to convene a range of service necessities of customers in an active and uncertain business environment. As a consequence of the dynamic environment in which supply chain must operate, 3PLs should sustain an effective distribution system of high performance and must make a sequence of inter-related decisions over time for their distribution networks. Warehouses play an important role in sustaining the continual flow of goods and materials between the manufacturer and customers. The performance of the 3PL supply chain network can be effortlessly enhanced by a balanced allocation of customers to warehouses. In this paper, the authors develop a genetic algorithm and a particle-swarm-optimisation algorithm for solving the balanced allocation problem and the results are encouraging.

DOI: 10.4018/978-1-4666-2461-0.ch010
INTRODUCTION

A supply chain management (SCM) is a network of facilities and distribution options that perform the functions of procurement of materials, transformation of these materials into the intermediate and finished products and the distributions of these finished products to customers. The SCM provides strategies, tools and techniques for both executives and managers in production, purchasing, inventory control, customer service and distributions.

The central aim of supply chain management - to have the right products in the right qualities at the right moment at minimal cost - is translated into the interrelated issues of customer satisfaction, inventory management, and flexibility. Supply chain network design decisions include the locations of manufacturing, storage, or transportation related facilities and the allocation of capacity and roles to each facility. Network design decisions have a significant impact on performance because they determine the supply chain configuration and set constraint within which inventory, transportation, and information can be used either to decrease supply chain cost or to increase responsiveness. As markets become competitive and influenced by a number of factors, companies endeavor to design a competitive strategy that will enable them to remain competitive and ensure customer satisfaction. In this endeavor, it is being increasingly realized that building a good network in supply chain is important for any firm, which is geared towards providing customer satisfaction and thus maintaining a competitive advantage (Singh, 2008). A company has to focus on the network design as its demand grows and its current configuration becomes too expensive or provides poor responsiveness.

Logistics has become more and more mature and sophisticated by taking on an external focus, incorporating suppliers and customers in the business processes, with all the supply chain functions integrated into a whole. By minimizing the costs in the value chain or providing customized services, logistics acts as a major source of competitive advantages and profitability. To meet this goal, it would require the integration of activities to focus on customer-oriented measures (Ling et al., 2009).

Once produced, goods need to be delivered to customers in a cost-effective way that still meets expectations regarding service and availability. The outbound logistics puts its extensive experience in warehousing and distribution of finished goods at the disposal of clients worldwide. The increase in competition and the swings in the economy in the last few years are forcing manufacturing firms to cut costs and improve customer service. With the induction of technology and better manufacturing practices in the last few years, many firms feel the scope to improve efficiency within the factory premises has substantially narrowed. However, the situation is quite different when it comes to outbound logistics.

The outbound logistics mainly focus on the transportation of the goods from the manufacturer to the customer through warehouses. The main concerns are the operation of delivery services, the processing of the orders, and accuracy of delivery. The activities involved are usually related to the material flows and warehouse management.

Today’s business success, to a great extent, depends on logistics and supply chain performance. More and more companies, especially manufacturing firms, obtain their competitive advantages through creating successful logistics outsourcing alliances to optimize value and performance (Liu et al., 2009). Outsourcing is nothing but the purchase of material or any other mean from the other domestic or international firm in order to concentrate in their core business. Outsourcing not only involves the materials and goods but also includes the transportation, marketing, etc.