

A Metaheuristic Approach for Facilities Location with Balanced Allocation of Customers

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Abstract

Organizations are constantly looking for innovative strategies to face more stringent competitive environments and the ever increasing market globalization. An alternative these organizations can pursue to respond to these challenges is to optimize their supply chain network (SCN). Important considerations when optimizing a SCN involve determining locations for plants and distribution centers (DCs), as well as allocating customers to DCs. Poor decisions when allocating customers to DCs may lead to deficient customer service levels, ineffective delivery schedules, and unequal workloads within the distribution system. Therefore, a balanced allocation of customers is an approach that can help organizations prevent these problems.

The main objective of this research was to develop a methodology to generate feasible solutions to the multi-objective, single-source capacitated facility location allocation problem (SSCFLAP) with a balanced allocation of customers (BAC) for a two-echelon SCN. The characteristics of the SSCFLAP-BAC and the assumptions considered when modeling the problem make the solution methodology applicable to regional retail chains that distribute product types that are large in size, including aluminum rods, decking boards, drywall panels, and lumber, to name a few. The multi-objective SSCFLAP-BAC is an NP-hard problem for which exact methods are not guaranteed to generate good solutions. Therefore, a modified version of the Non-Dominated Sorting Genetic Algorithm (NSGA-II) was utilized to obtain a set of Pareto optimal solutions for the SSCFLAP-BAC for three different problem instance sizes.

A designed experiment was conducted to assess the effect of several main factors on the five supply chain response variables *total cost*, *balance level of transit time*, *average total transit time*, and *number of opened DCs and plants*. The ANOVA results show that customer demand has the largest effect on the total cost, whereas unit shipping cost has the largest effect on the balance level of transit time.

It is expected that the main product of this research will aid manufacturing firms in improving their strategic decision making when designing their SCN and in better understanding the tradeoffs among the organization's conflicting criteria.

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