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A META-HEURISTIC APPROACH TO A STRATEGIC MIXED INVENTORY-LOCATION MODEL: FORMULATION AND APPLICATION

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In the present day, it is increasingly more important for the companies to have a distribution network that minimize the logistic costs without reducing the level of service to the customer (delivery time, enough inventory, etc.). To reach conciliation within these objectives that may look conflicting requires developing some tools that allow decision-making. Having this in mind, the authors present a strategic inventory-location model, multiproduct and different with demand periods. This is a complex problem of integer mixed programming, that allow to determine the optimum distribution network given the fixed, transportation and inventory costs. The problem is illustrated by applying it to a real case of a steel company in Colombia, to resolve it, exhaustive revision and a genetic algorithm were used. The results obtained reveal the importance of the making joint strategic-tactic decisions, as well as the impact of each of the variables considered in the logistics costs.

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Keywords: Distribution network; inventory location; distribution centers location; genetic algorithm; exhaustive revision.

1. Introduction

In a context of a globalized market, companies are forced to develop innovation methods that allow them to differentiate from their competitors. An interesting case is the one from the companies that produce low-density value goods, where the logistics costs have an important impact on the products final price, so it is necessary to optimize

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them without decreasing the level of service. In addition to the cost reduction, to offer a better level of service is crucial to keep and attract customers.

Logistic strategies as in how to broaden the network distribution centers (DC) of the companies are an interesting option because they cover both problems simultaneously: they offer an effective and rapid response to the customers (optimize level service) and on the other hand they allow to consolidate shipment to the DC. Which with the taking advantage of scale economies of scale it can translate into important savings on transportation costs. However, making the decision to create new DC implies a serious amount of investment and it must be supported on an economic evaluation, which requires a detailed analysis.
An optimal design of a distribution network is one of the most difficult problems managers and operation investigators encounter, the decisions that concern this design can be broken down into three levels (Berman, et al., 2011).

- Strategic: how many facilities it's going to have and where to locate them
- Tactical: Where to keep the inventory and how much could it be stored in each facility
- Operational: How to organize the transportation flow between facilities.

The levels explained above result very difficult to clarify by themselves, and by tradition they have been worked separately. On the past years a strong movement for the integration of levels 1 and 2 has existed (strategic and tactical) through the models of inventory location (Daskin & Coullard, 2002).
The great interest in integrating these levels stems from the premise that inventories consolidate multiple facilities in one has been shown to reduce inventory costs (Eppen, 1979) .

A general problem of locating facilities includes a series of spatially distributed clients and a set of facilities to supply those customers (Figure 1), from which they must answer the questions of which facility should be used? Which customers will be served by each facility in order to minimize costs? In addition to these basic questions, different constraints and considerations have been added depending on the application (Melo, et al., 2009)

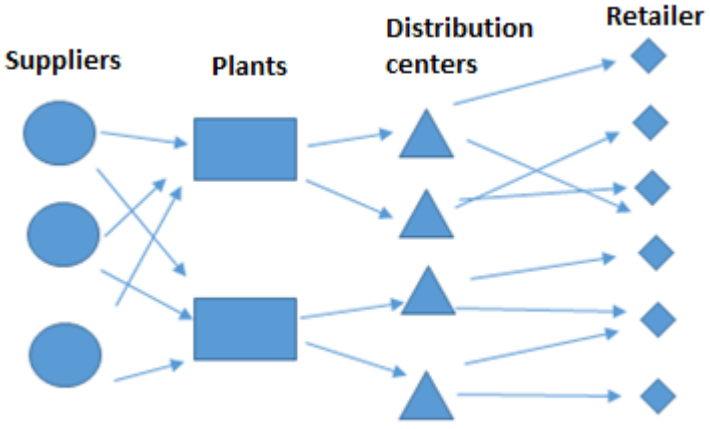

Figure 1. *Generic facility location*
Source: Author

In this paper, a mathematical strategical-tactical model for the optimization of the distribution networks is proposed. For its application there was a gathering of information of a company in the laminated steel sector and as a result it was determined for their case which will be the best configuration for their distribution network , the number of facilities needed, and the client allocation for each facility, this taking into account the costs derived from the cycle inventory and safety stock, as well as the fixed costs of new facilities and of transportation between the different points of the distribution network (plant, facilities, demand zones).
Although the model shows levels of inventory for the installation of the networks, these may not be considered as the