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TRANSPORTATION'ROLE IN THE SUPPLIER SELETION DECISION

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Abstract - A review of literature on the supplier selection problem show that very few studies highlight explicitly, the weight of the transportation policy in this selection. In this paper, we propose a mixed non-linear programming model which determine, for a product, the number of suppliers to choose, the quantity to be ordered to each one and the impact of transportation in suppliers, transit and buyer inventories. An evaluation of the model is presented under various scenarios.

I. INTRODUCTION

In the current competitive environment, it is extremely difficult to successfully produce high quality, low cost product without collaborating and narrowly with a network of effective and reliable suppliers. The supplier selection process becomes strategic because, on the one hand, the costs of raw materials and finished components are very significant and can go from 50% to 80% of total product cost [WEB, 91] and on the other hand, because this process implies decisions which directly affect the total performance of an organization.

A review of literature on the supplier selection problem shows that many studies are focused in the determination of supplier selection criteria and methods to evaluate their performance. However, very few contributions highlight, in an explicit way, the role that the transportation policy can play in this selection. This is a great limitation because transportation cost represent up to 50% of total logistic cost [THO, 96], [STA, 00], which is extremely heavy for the buyer. Additionally, transportation and inventory elements (of the supplier, in transit, of the buyer) are highly interrelated and contribute most to the total cost of logistics : costs incurred in the suppliers while the products await to be shipped, costs represented by the products in transit, storage costs at the recipient.
In this article, we propose a supplier selection model which taking account of transportation. We expose our approach while presenting in a first part, a review of literature on the supplier selection problem. In the second part, we present our model before drawing some conclusions and prospects.

II. REVIEW OF LITERATURE

The first writings on supplier selection problem are those of Dickson [DIC, 66] which, starting from an investigation carried out near 274 reponsables of the purchasing department in Canada and USA, could identify 23 criteria used by the companies in the Sixties to select their suppliers. This study also indicates that the supplier selection process is multi-criterion. Weber, Current and Benton (1991) confirm this result by showing, starting from an analysis of 74 articles on the supplier selection problem, that the work of Dickson is in reference in the majority of them. On the other hand, the change of the industrial context and the introduction of the Just-In-Time concept modified relative importance of each criterion. The same authors also showed that the quantitative approaches of supplier evaluation may be grouped into three categories which are : linear weighting models, mathematical programming models and the statistical/probabilistic approaches. Ten years later, other techniques appeared in the literature. We can mention : data envelopment analysis [WEB, 96], [LIU, 00], goal programming [WEB, 00], interpretive structural modeling [MON, 94], expert system [VOK, 96], etc. In these various approaches, transportation cost is only considered implicitly in total product cost. To evaluate this cost, a review of literature indicates that there are several modeling [BUR, 85], [GAN, 99], [MAR, 01]; each allows to reflect the economies of scale that the company can carry out while transporting of larger loads.

In the continuation of this article, we propose a model which treat, in an explicit way, the transportation's role in the supplier selection decision.

III. PROPOSED MODEL

We are interested in transportation between the suppliers and the buyer central warehouse. Transportation between buyer central warehouse and its warehouses/workshops does not return within the framework of our problem..

The buyer company must make a choice among several suppliers, on the basis of criterion which takes into account transportation, namely : total product cost and lead time. The objective is to minimize the total cost including purchasing, ordering, transportation and storage costs. The lead time is formulated as a constraint.

To evaluate the transportation cost, we retain the modeling suggested by Martel [MAR, 01], which consists in finding a linear approximation of this cost by regression between an origin and a given destination.

As for the storage cost, we consider that it is composed of three costs:

- the cost incurred in each supplier while the product await de be sipped,
- the cost incurred during the transit,
- the cost incurred in the buyer central warehouse.

The most important constraints of the problem are :
- for each supplier : lead time required and production capacity,
- for the buyer : lead time imposed and period demand,
- for transportation : capacity and means of transport.

Moreover, the following assumptions are considered :
- each vehicle is affected to each supplier,
- a vehicle has the same mean transit time between a supplier and buyer,
- the periodic demand is known and constant.

Our model takes the form of a mixed non-linear program. Two types of decision variables are employed : the binary variables which correspond to the supplier selection and the variables which correspond to the percentages of total lot size to be shipped to each supplier by a means of transport given. An evaluation of this model is presented under various scenarios.

IV. CONCLUSIONS

A review of the literature on the supplier selection problem allows us to note that very little studies was interested in the transportation' role in this selection. We proposed a model which contributes to a step of assistance to the suppliers choice and for a product, to determiner the number of suppliers to be retained, the quantity to be ordered to each one and the impact of transportation in suppliers, transit and buyer storage. Work remaining to be made relates to the model validation and its application on real cases.

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