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# A dynamic mathematical programming for supplier selection-order allocation

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*Abstract*— **Performance evaluation of the supplying firms is being recognized as one of the critical indicators. In the last two decades, several studies have been conducted on the issue that most of them have used of Multi Criteria Decision Making (MCDM) methods. The purpose of this study is investigate the applicability of the numerous measures and metrics in a multi-objective optimization problem of supply chain network design with the aim of management in allocating orders by coordinating production lines to satisfy customers demand. This work presents a dynamic non-linear programming model that examines the important aspects for the strategic planning of the manufacturing in supply chain (SC). The effectiveness of the configured network is illustrated using a sample, following which an exact method is used to solve this multi-objective problem and confirm the validity of the model, and finally the results will be discussed and analyzed.**

***Keywords-supplier selection; order allocation; multi-objective optimization; dynamic non-linear programming***

## I. INTRODUCTION

The objective of supplier selection is to identify suppliers with the highest potential for meeting a company's needs consistently [1]. Besides, supplier selection is considered a Multi Criteria Decision Making (MCDM) problem that includes both quantitative and qualitative factors. In order to it needs to make a tradeoff between both tangible and intangible factors for selecting the best.

Attention to risk management and related techniques is growing in SC, especially after the recent financial crisis. Therefore, in this paper we illustrate risk equation as an objective. Several studies in the past have had a thorough review on the effects of SC disruption in the operation performance and its probable damage on the company's benefits. For instance, reference [2] provided a recent and comprehensive review of the same issue.

The SC network is formulated as multi-objective mixed integer non-linear programming (MINLP) model that is designed for multiple considerations of the estimated supplier weight, cost and risk. Then a compromise programming is adopted to determine the weight of each objective function and final model is solved by Lingo software. Eventually, an example is conducted to test the validity of the model.

The remainder of this paper is organized as follows. After brief review the relevant literature in Section 2, in Section 3 we define and develop mathematical formulation. In Section 4, solution method is presented and used a numerical example of its occurrence to show the applicability of the model after which is reported the computational test of its results. Finally, concluding remarks and directions for further development are provided in the last Section.

## II. LITERATURE REVIEW

Performance evaluation of the supplying firms is being recognized as one of the critical indicators [3]. The literature on supplier evaluation exist some surveys (i) focused on problem criteria, and (ii) proposed methods for selection process. In identification of the qualitative and quantitative criteria after [4], [11] described 18 criteria. Reference [5] extensively reviewed, annotated and classified 74 related articles, which have appeared since 1966, and specific attention is given to the criteria and analytical methods. They concluded that quality, cost and on-time delivery are the three most important supplier selection criteria commonly used.

In the last two decades, various decision-making approaches have been proposed to tackle the problem of supplier evaluation and selection; please refer to recent reviews in [6] and [7]. Based on the applications of AHP and fuzzy AHP have been very popular. This methodology has been used to rank potential suppliers in a hierarchical manner.

Mathematical programming models as the techniques used for evaluation have significant problems in considering qualitative factors, which are very important [8]. In this area, multi-objective optimization models have been proposed to identify appealing tradeoffs between two or more conflicting criteria that are involved in the order allocation process. See [9-13].

The use of fuzzy set theory for modeling and analyzing decision systems is of particular interest in production management. This is because of fuzzy theory's ability in quantitatively and qualitatively modeling of problems