Fuzzified TOC Product-Mix Decision for Measuring Level of Satisfaction

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Abstract – Industrial decisions should take into account considerations like the decision-maker’s (DM) level of satisfaction while making a decision. In this paper, a Membership Function (MF) has been suitably designed, first in finding out the degree of imprecision in the product-mix decision, and thereafter to sense the level of satisfaction of the DM. Inefficiency of traditional Linear Programming (LP) in handling multiple-bottleneck problem through TOC has been discussed through an illustrative example. Comparison of traditional LP over fully fuzzified LP (FILP) model has also been addressed to elucidate the advantages of FILP in TOC. Key objective of this paper is to guide DMs in finding out the optimal product-mix with higher degree of satisfaction with lesser degree of fuzziness under tripartite fuzzy environment.

Keywords: Fuzzy Linear Programming, TOC, Product-mix decision, Fuzziness patterns, Level of satisfaction.

1 Introduction

This work outlines a fuzzy linear programming (FLP) approach for improving solutions obtained from TOC, and compares the solutions obtained by Hsu and Chung [12] and Onwubolu and Mutugri [19]. The available literature in TOC product-mix decision is broad. Literature contains several proposals on how to revise the TOC product-mix decisions to identify the optimal product-mix under conditions where the original TOC heuristic failed.

Goldratt [9, 10] devised the TOC philosophy in the arena in manufacturing science. Umble and Srikant [26] presented a detailed look at the concept. Goldratt [10] improved his concept of TOC by the management philosophy on improvement based on identifying the constraints to increasing profits. It was shown that product-mix decision-problem under TOC could be mathematically tackled as a linear programming (LP) model [9, 10]. Luebbe and Finch [16] compared the TOC and LP using the five-step improvement process in TOC. Lee and Penner [15] illustrated two examples of product-mix decision problem and concluded that TOC solution was inferior to the optimum solution and had the possibility of being infeasible when multiple constrained resources in a plant existed. Hsu and Chung [12] presented a dominance rule-based algorithm that classified non-critically constrained resources into three levels for solving the TOC product-mix problem when multiple constrained resources existed. Fredendall and Lea [7] revised the TOC product-mix heuristic to identify the optimal product-mix under conditions where the original TOC heuristic failed. Methods to identify a product-mix which maximizes profit have been studied extensively. One method, known as integer linear programming (ILP), is often used to optimize the product mix. But it requires a high level of expertise to formulate and may take hours to solve. Researches reveal that TOC heuristic is simpler to use than an ILP [16]. But some researchers identified conditions under which TOC could create a non-optimal product-mix [15, 21]. Extensive studies have been carried out to identify product-mix that maximizes profit by Buxey [5].


Many researchers proposed variations of Goldratt's [9, 10] product-mix problem. Lee and Penner [15] demonstrated that TOC was inefficient when new product was introduced. Their observation was that the solution from TOC during introduction of new product produced a non-optimal product-mix. Penner [21] discussed an example having multiple constrained resources to show that the TOC heuristic didn't provide an optimal feasible solution. Patterson [20] and Goldratt [10] tested the TOC...